See Back Cover!

JANUARY 25c

POPULAR AVIATION

SEE PAGE 22

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TECHNOLOGY

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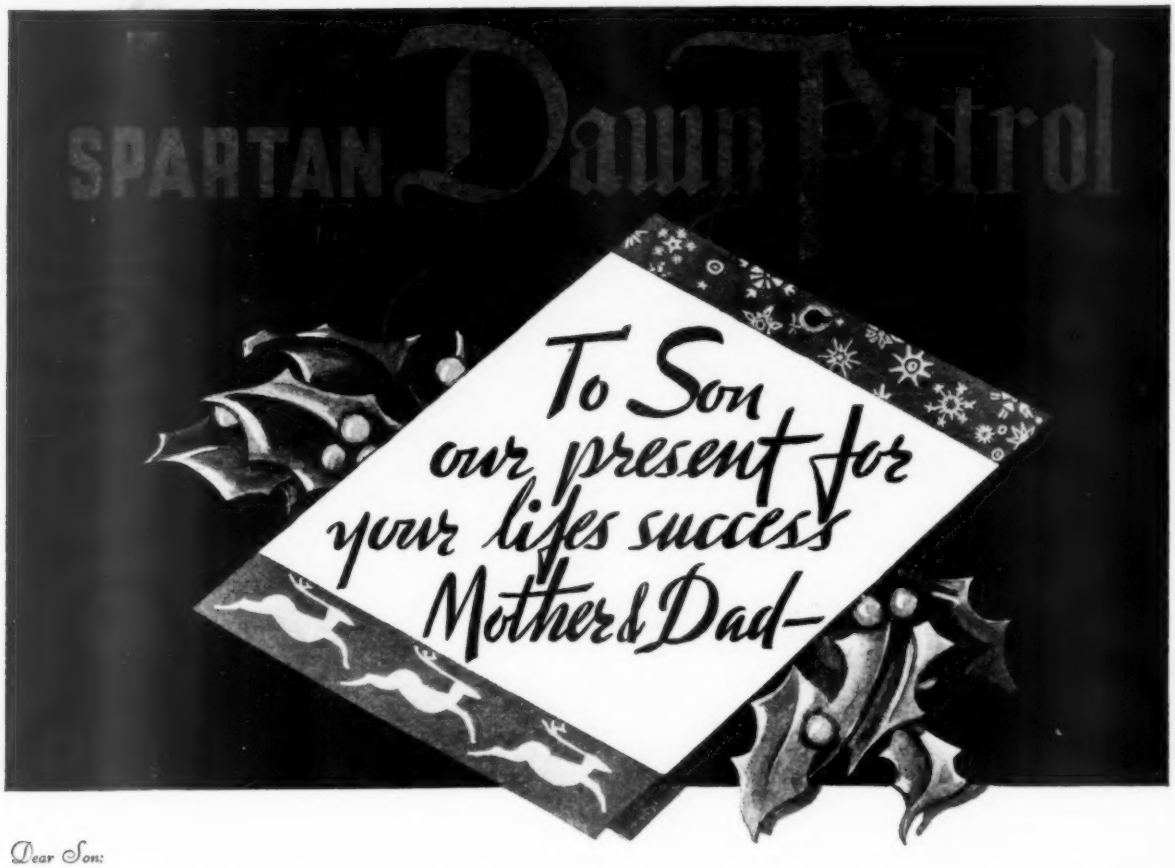

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This year Mother and I are saying "Merry Christmas" with the one present that will bring you happiness throughout your life. To us it means more than just the joy of giving—this course in the Spartan School of Aeronautics we feel will give you the proper training to fit you for your opportunity in one of America's fastest growing Industries—Aviation! At Spartan we will have the confidence of knowing that in the Dawn Patrol you will associate with the finest youth of the world—young men, like yourself who will be studying in enjoyable surroundings, with instructors and equipment that has made Spartan an outstanding name in Aviation Instruction. This Christmas will be a happy one for us all in the realization that at Spartan with the Dawn Patrol we are providing you the opportunity for a successful future.

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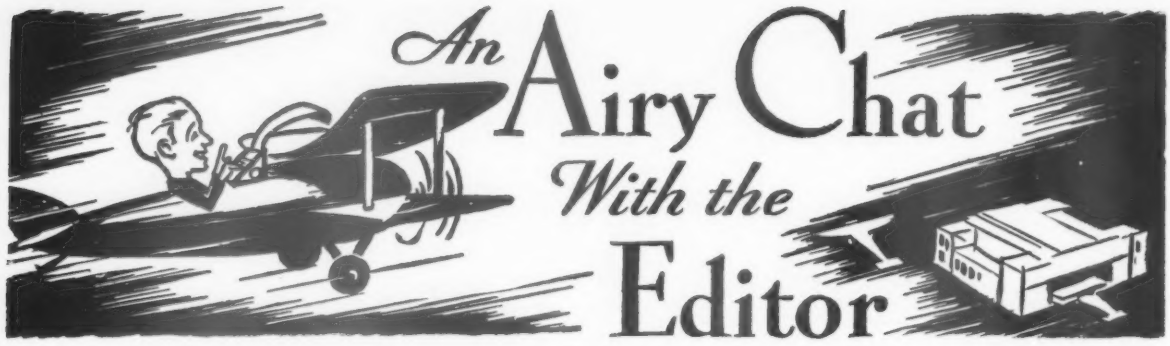

An Airy Chat With the Editor

YULE TIDE brings memories, resolutions for the future, retrospection and all the rest of it but, best of all, it brings old Santa out for his annual airing. And Santa has become the real spirit of the day, taken from any standpoint.

Somehow, of recent years, Christmas appears to have lost much of its basic religious significance and has emerged, whole winged, into a season of good cheer and good fellowship. And it is in this sense that we send our hearty greetings to you for a Merry Christmas, quick takeoffs and a good old three-pointer at the end of the day.

* * *

FIFTEEN years ago, or some such matter, some kind hearted visitor left us with a cotton stuffed Santa Claus doll on our hands but left no instructions as to its use or purpose.

The office staff, however, being 100-percent. airminded, devised the ingenious scheme of providing old Santa with a pair of paper wings and then sailing him out of the fifteenth story window—which was promptly done. After much discussion as to angle of attack, c.g. location and inherent stability, Kris Kringle made his take-off with surprising results. He displayed a most remarkable gliding angle and jumped up and down with the thermals around the tall buildings like nobody's business until, finally, he made a full sweeping turn and started back toward the office.

On, on, he came at a good thirty miles per hour, allegorically speaking, with the wind on his tail. And then, just short of his destination, down went his snoot and, with a loud crash, he disappeared through a neighboring skylight! Wonder what the guys under that skylight had on their minds at the moment when a fully garbed Santa doll with a half pound of lead ballast in his head, cracked up within their midst?

As for us, we gently closed the window and tiptoed away from there. And our discretion proved the better part of valor when we eventually discovered that the broken skylight covered the office of the police commissioner. Merry Christmas to you, Commissioner!

* * *

AND THEN comes the memory of that blustery snow-ridden Christmas Eve blizzard in which Elmer Partridge went out with the airmail and never returned. Christmas has its sad recollections as well as the happy cheerful memories, and perhaps it is well that this is so.

AND NOW, let's end our Christmas reveries and get down to the present business of aviation which is a rather difficult subject for those who dwell in the areas between 40-degrees latitude and the North Pole. In short, private flying is not so hot in these regions at the present time of writing but there are still a few hardy souls who defy the weather, warm up the lube oil and go out for a refrigerated tour. It is gently whispered, hereabouts, that with the coming of the cabin planes that there is a notable increase in winter flying, but in confidence it's too cold for me to even take a trip to the airport for the verification of these whispers.

* * *

MANY amateurs and private owners either own flying-boats or else have had floats fitted to their landplanes as accessories, but so far as we are informed, only two of the lads have fitted skiis or runners to their planes for winter landings and takeoffs. There seems to be no reason why this should be a particularly difficult task and it probably would add considerably to the pleasure of airplane ownership.

* * *

STRANGE as it may seem, the venerated National Air Board has just discovered that it is possible to fly a lightplane with a converted automobile engine! Can you imagine anything like this when POPULAR AVIATION has been publishing the innermost details of such amateur achievements in nearly every issue for the past eight years?

* * *

WE WERE mighty glad to welcome Joan Thomas on her return from Europe where she has spent the past sixteen months. Miss Thomas, among very many other accomplishments, took out a pilot license in England and it is likely that she is the first American woman pilot to achieve this honor. She has picked up a multitude of interesting facts regarding European aviation which she will write for our readers in forthcoming issues of POPULAR AVIATION.

* * *

TEACHERS in accredited schools are invited to write the Subscription Department of POPULAR AVIATION for details of an interesting and valuable subscription plan.

* * *

AND another item of interest. On page 45, of the October issue, we erroneously credited the photo of the gas-powered model "Miss Alice" to Donald Krauss. This model was really built by Fred Gerling, Columbus, Ohio, who claims that he spent many long hours of work on the ship and who, therefore, deserves credit for his undertaking.

* * *

DUE to our rapidly increasing circulation in Europe, we are receiving many interesting letters from our readers on the other side of the water and, what is better yet, many photographs of interesting planes, engines and accessories which we will be glad to publish from time to time. Our English correspondents are particularly vigilant and obliging with their comments, and to them we extend our thanks.

* * *

READERS who have complained that the last few issues contained but little dope on the subject of gas-driven models should be reassured when they receive this issue of P.A. We have shown a number of models constructed by our readers and this, coupled with the article by Raoul Hoffman, should indicate our continued interest in this subject.

* * *

NORRIS HAUGON, Merrill, Wis., sends interesting news for which we thank him. His letter, in part, reads as follows:

Boy, this is a compliment to you! Here's what I received from a foreign correspondent of mine in Cairo, Egypt, Mohammed Ald Alla Billassy:

"I am interested in nearly everything, especially in aviation. I spend nearly all my pocket money on buying books and magazines concerning aviation. One of the magazines I buy is an American magazine called POPULAR AVIATION.

"I have read many books and I have seen many magazines about both English and American aviation, but I tell you that I prefer the American aviation magazine (POPULAR AVIATION). I do not tell you that because you are American. No, it's true and it will not take very long explanations."

We certainly appreciate this friendly message and trust that more Egyptians will become as interested as our friend.

* * *

BRINGING UP the subject of our questionnaire again, we found it extremely interesting to discover the great diversity of trades and professions followed by our readers. This indicates, of course, the universal appeal that aviation makes to all red blooded men.

(*Concluded on page 63*)

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POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF PRIVATE FLYING AND COMMERCIAL AVIATION

Volume XX JANUARY, 1937 Number 1

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Importance of Patrol Planes

The Martin PM-1, a Naval Aircraft Factory design built by Glenn L. Martin, is soon to be replaced by the XP3Y-1.

Consolidated P2Y-3 provided with two 750 h.p. Wright Cyclone engines.

by
ROBT. McLARREN

IN a recent interview with the press, upon taking command of the United States Fleet, Commander Arthur J. Hepburn commented concerning Naval patrol planes: "Huge flying boat patrol type planes are becoming more important in our Pacific frontier defense.

"In the past few months we have had outstanding successes with newly developed types and plan to increase our present force by a large number of recently ordered planes. Their speed and extremely long range make them superior to lighter-than-air and surface craft and we are urging immediate development of this important branch in our national defense."

Growing unrest in Pacific waters has placed a new importance on long range patrol duties. This vast area cannot possibly be patrolled by surface craft and the Navy has wisely turned to the air for the solution to their problem.

The prime attribute of the flying patrol boat types is their speed. No surface craft of even racing design, let alone service type, can approach the 160 miles per hour cruising speed of the latest type patrol planes.

In the event of a rising problem in mid-Pacific of a miltary nature where immediate appearance on the scene is more important than large forces, no type of Naval conveyance could reach the scene before the huge flying cruisers.

A huge squadron of flying patrol boats could reach the objective, annihilate the enemy with its tons of lethal punishment, and score a complete triumph before the first of the surface craft might be well out to sea en route. Death from the skies insures a psychological fear in the enemy far greater than might be effected by screaming shells from battleships.

Distance is but the passing of time to the crew of a huge patrol plane. Recent nonstop flights of over 3,500 miles exemplify the long range ability of recently accepted types.

This vast cruising range encompasses from its San Diego base the tipmost point of Alaska, the Panama Canal, and westward, past Hawaii to Midway Island, important base in present trans-Pacific air line operation.

Thus, within twenty-four hours Uncle Sam might have a vast armada of flying arsenals raining death on an imperialistically inclined neighbor who has trod upon one of her three most valued outlying possessions.

At the same moment the United States Fleet, within the prescribed twenty-four hours, might have cleared San Diego harbor and be 500 miles out to sea, just 3,000 miles from the scene of the disturbance!

A useful load of 17,500 pounds demonstrates the foresight of design in these huge craft. Considering 7,500 pounds as an estimate for service weight expenditure we still claim five tons for armament load!

Consider the psychological effect of a huge, roaring, flying dreadnaught charged with five tons of potent destruction traveling at a 180 mile per hour speed appearing from a group of low lying clouds on the horizon. Fear would be but an impotent background for the installation of a stark terror should this picture be painted in realism!

And yet, nestling snugly on powerful cradles on ramps or dipping rhythmically with the swells in the harbor are a fleet of such gargantuan air raiders at North Island Naval Air Station, the U. S. Navy's Pacific Coast Air Base at San Diego, California.

Across the bay the salt air is filled with the staccato beat of the rivet hammer as scores more of these mighty conveyors of death are rushed to completion. Certainly the pacifists, the arch-enemies of the security of national defense, can no longer scream their pleas for de-militarization of this nation with these facts forbidding the opening of their lips!

The protagonists of man's exorbitantly expensive folly, the dirigible, also come to the fore in the face of these developments and expound their theory of coastal defense.

None of us, regardless of our views concerning these huge playthings, can deny our adversary's argument that the dirigible boasts a cruising range far in excess of anything that travels, and a load carrying ability exceeding any flying boat as yet conceived. Neither can they deny us the fact that for the cost of every single dirigible appearing on the horizon the sky might well be darkened with a fleet of huge roaring patrol planes.

The dirigible is a pitifully defenseless creature. Three small wisps of pursuit planes might make short end of one, even a single plane in the hands of an expert pilot, for that matter. But we challenge even the suicidal-insane members of a "La Desperata" squadron to attack a closely formed armada of all-metal flying boats, their gunners bristling from alcoves in the sleek hulls, covering each other in a deadly cross-range!

The flying boat is not a recent develop-

For Our Coast Protection

ment of the U. S. Navy and must not be regarded as such. The first aircraft, specifically ordered by the Navy Department and constructed under government contract, was of the flying boat type. The earliest demonstration of long range ability on the part of these multi-motored craft was the historic flights of the "NC's," particularly the trans-Atlantic achievement of the "NC-4." Since its insurrection in the early "teens," the Navy has carried on a vast and successful program of flying boat experimentation.

It was the realization of the importance of these types which led to the formation of the Navy's own aircraft construction program and the Naval Aircraft Factory at Philadelphia. Throughout this entire program these craft were aptly titled "flying boats." Naval architects designed the most excellent of boats, thrust holes in them for cockpits and turned them over to the aeronautics department.

It was then up to these educated masters of the slide-rule and logarithm tables to put these tubs in the air. Wings were optimistically attached, wires were very generously apportioned to each strut and brace, and the entire contraption issued to a most grossly optimistic test pilot.

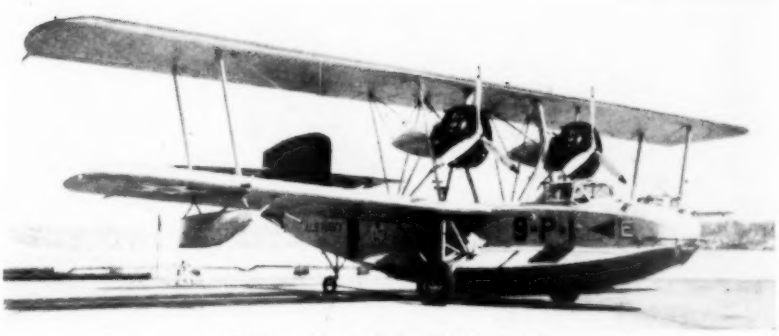
Year in and year out this sad state of affairs continued until the construction staff became weary and suggested that Mr. Martin and Mr. Douglas were really very excellent patrol boat builders. No sooner said than done and Naval Aircraft Factory designed flying boats were soon being completed by the Martin and Douglas companies.

The last of these hybrid craft appeared in 1928 and then the designing staff at the N.A.F. became weary. Here was truly a sad state of affairs, yet rather than disturb this dormant and obviously efficacious condition, the doors were softly closed and the gentlemen slumbered on, and on.

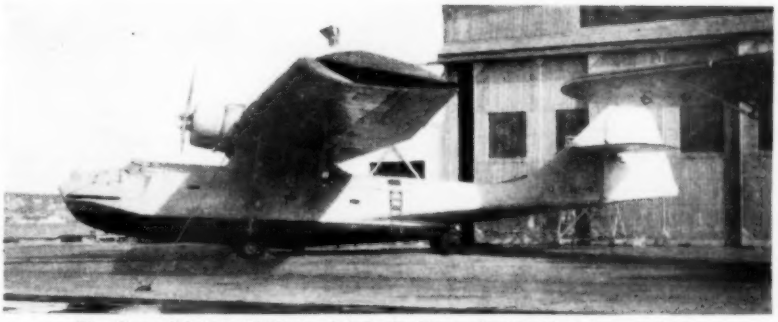
Happily there reposed within the stout breasts of Mr. Douglas and Mr. Martin, not to mention "Mr. Consolidated," a heart which beat with the sound rhythm of a patriot. Beams and supports began to be knocked out of their factories and huge flying boats of their own design and construction began to take shape.

Consolidated brought forth a commendable design and an order was forthcoming from the Navy Department. These ships, the P2Y-1 design, very quietly roared away in a mass flight from Oakland to Hawaii, the first time such a flight had been undertaken. But first flights became a habit with the Consolidated concern and gold placards soon filled their offices.

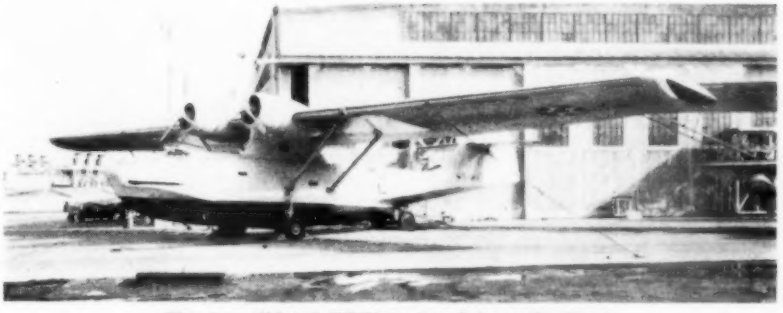
Profiting by this experience they designed and constructed the ship which now holds the spotlight on the patrol boat stage. Known technically as the XP3Y-1 (this will be changed to PBY-1, Patrol Bomber, in the service deliveries), this all-metal,



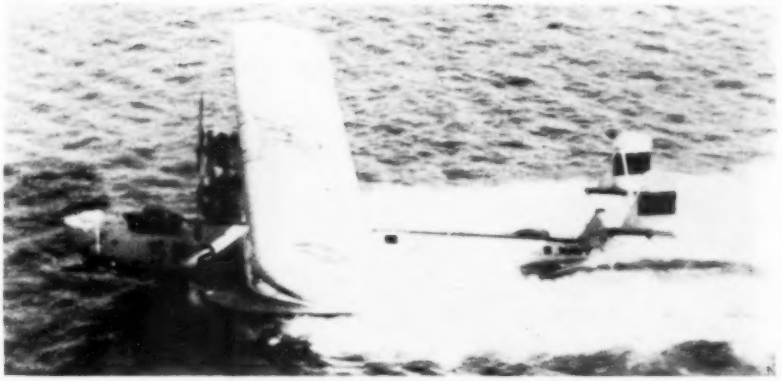
Another view of the Martin PM-1.



The Consolidated XP3Y-1 with Twin Wasp Senior 1,000 h.p. engines.



The Consolidated XP3Y-1 viewed from the front.



Consolidated XP2Y-1 with 700 h.p. engines.

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New British War Plane Passes Tests

Here is the new Westland military co-operation ship caught by the camera on its first demonstration flight in England recently.

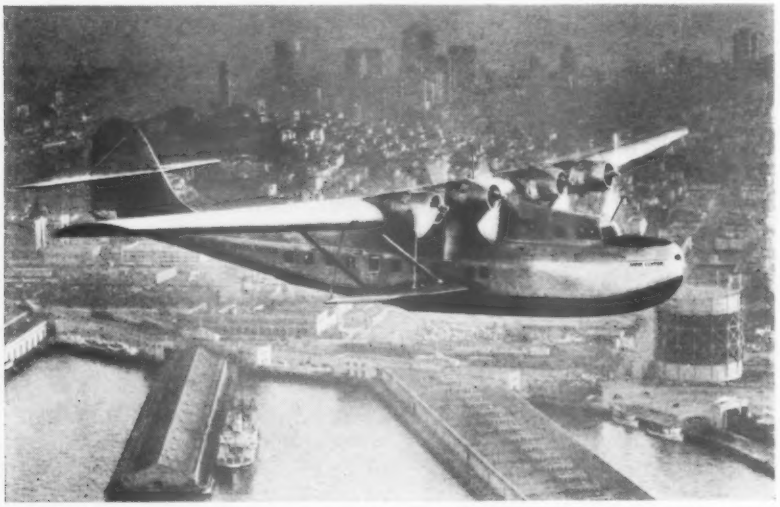
GREAT BRITAIN'S frantic drive to bring her military and naval forces up to maximum strength has resulted in one of the most intense design and construction programs by British aircraft builders in that nation's history. The ship shown above is just one of the newer types to take the air close on the heels of Parliament's air force appropriations.

Known as the Westland army co-operation monoplane, the above ship is an excellent example of the high speed program for aircraft now under way in the British Isles. Starting from the drawing paper, British engineers designed, built and flew the above ship in 12 months flat.

Pan American Ocean Service Opens

HONOLULU, Midway, Wake, Guam and the Philippines all are now available to the air passenger who would rather get there, spend all the time they want vacationing or transacting business, and be back home before the average Pacific Ocean liner could get them there.

Pan American Airways System recently carried its first scheduled load of paying passengers after more than two years of the most exhaustive research work with aircraft, other equipment and operations in the history of American airline transportation.



China Clipper soars out over San Francisco Bay headed west to the Orient with its first cargo of regular passengers.

January in Aviation

by ERNEST L. JONES

TURNING the pages of Time one finds weird and wondrous dreams, legends and records of man's attempts to conquer Nature's most obstinate law.

Under the influence of the zodiacal sign, "the goat," the three magi are said to have reached Bethlehem "on the 13th day (of January, 4 B. C.) after Christ's birth by a miraculously rapid transit by day and by night of these and their armies to the marvel of the inhabitants of the towns through which they passed or rather flew," says Thorndike in his *History of Magic*.

* * *

1556. Charles V., Emperor of Germany and King of Spain, retired to a monastery where he amused himself with his engineer Turrianus, who made "certain small birds to fly" and sing—FLYING MODELS.

1784. LARGEST BALLOON to the date, 540,000 cubic feet, ascended at Lyons with a payload of 2½ tons, including Pilot Jos. Montgolfier and six other passengers. Brisson of the French Academy read a paper on the propulsion of conical-ended AIRSHIPS and proposed the utilization of the air currents in navigation.

1785. On the 7th the American, Doctor John Jeffries, and the Frenchman, Blanchard, made the FIRST CHANNEL CROSSING by air, in a balloon.

1793. On January 9 Blanchard made the FIRST AIR VOYAGE IN THE U. S. from the capital at Philadelphia in the presence of President Washington, who gave him a letter of introduction to all whom he might meet in the course of his ascent. He landed after 6½ hours in Woodbury, N. J.

1858. Henry Coxwell described his plan for EXPLORING AUSTRALIA by air. In this year balloons first appeared in that country after half a century of use elsewhere.

1861. Dr. Pierre Moreaud was working on the application of STEAM POWER to the airship as Prof. T. S. C. Lowe was preparing for his famous flight into the South, made just after Ft. Sumter was captured by Johnny Reb.

1871. On Jan. 28 closed the WORLD'S FIRST AIR MAIL SERVICE when the last of 65 balloons left Paris, having moved 10,675 kilos of mail during the German siege.

1882. EARLIEST MALAY KITE in America seems to be that of which drawings were printed in Dan Beard's *Handy Book*, published in 1893.

1906. Jan. 13-20 FIRST AERO CLUB SHOW held in New York in connection with the automobile exhibition at the 69th Regiment Armory. Exhibits included a model of the Langley airplane, photos, books and the balloons *Centaur* and *Orient*.

1907. Announcement made of committees comprising the Jamestown Aeronautic Congress, headed by Dr. A.

(*Concluded on page* 58)

Rhys-Davids—British Ace

by WILLIAM J. BOYLHART

An intimate story of one of Britain's greatest aces during the World War, his personality, traits and victories.

IN 1915, a fine looking young fellow by the name of Arthur F. P. Rhys-Davids decided that he had had enough of education. He left Eton, joined the Royal Flying Corps and so began the career of the youngest of the British aces. His age on his enlistment papers read eighteen, yet he was just sixteen years of age.

He came from Wales, a brown-eyed, bashful chap. He was a quiet fellow who shunned notoriety and made no allusions to his accomplishments. He learned his flying well, though his instructors frequently had to caution him against his recklessness.

On April 7, 1917, Lieutenant Rhys-Davids joined Fifty-six Squadron of the Royal Flying Corps. From the beginning he showed no exceptional promise and it was some time before he got into his stride.

The keynote of his career was his method of attack. He had no thought for personal safety. Whenever one looked in the center of a dog fight, there was Rhys-Davids. He cared nothing for numbers and would take on one Hun or fifteen with the same eagerness. His attack was flashing, fast, impetuous, audacious and determined. These adjectives scarcely define it.

To understand this, witness his combat of July 21, 1917. At six P. M. he and four others took off. Over Houthoulst Forest the flight took a crack at some Albatross scouts and became separated. Rhys-Davids met McCudden, the famous ace, and together they went after eight Albatross scouts who were above them.

Rhys-Davids immediately got into the middle of the formation of Hun scouts. As they were above him, he zoomed up and stood his S. E. 5 on its tail and hung there, on his propeller, shooting into the Hun scouts above him.

A head-on view of an enemy Albatross, showing its characteristic bullet nose and formed body.

Major James McCudden in his famous S.E.5 fighter.

Lieutenant Werner Voss Crefeld with a Fokker triplane just before he was shot down.

Most of the Albatross scouts then descended upon him and had it not been for McCudden's aid, the career of Rhys-Davids might have ended there. I say might, because Rhys-Davids got into so many combats, in which he was hopelessly outnumbered, yet extricated himself without harm. This combat ended shortly and Rhys-Davids landed to find that he had been awarded a bar to his Military Cross. This immediately became the cause of a celebration.

Rhys-Davids was noted for his fine tenor voice. He was a lover of good music and was the director of Fifty-six's orchestra. His diversions were his music, his pets and his garden. But his real interest was his beloved white rabbits. These pink-eyed rabbits and his small puppies claimed most of his time while on the ground.

He was a queer fellow, this Rhys-Davids, a quiet chap busy with his garden, his rabbits and his puppies, playing and singing—still a boy—though the war had changed him. But, in the air! He looked for combat and attacked with a fury that was little seen in other aces. He gave no quarter and asked none. While in the air he had no thought but to kill.

We will follow the latter part of his career. On August 15, 1917, Major McCudden joined Fifty-six Squadron and was assigned to lead "B" Flight, whose members were Lieutenants Barlow, Croyn, Coote, Muspratt and Rhys-Davids. On August 20, 1917, at 7:15 P. M., an Albatross D-3 fell, over Polygon Wood, to Rhys-Davids' guns.

Several times, while McCudden led the flight over this period, he had to caution Rhys-Davids against his foolhardy bravery. On September 9, 1917, over the southern

XUM

part of Houthoulst Forest, Rhys-Davids shot down two Albatross D-5s.

In the evening of September 14, 1917, he had a combat with an Albatross D-5 over Polygon Wood. The whole flight was engaged in combat with about twelve Albatross scouts. Rhys-Davids picked out an Albatross with a red nose, green fuselage and a silver tail. After the first burst of gunfire he realized that he was up against a skillful opponent.

They both flew carefully, until Rhys-Davids became impatient and dove directly upon the Hun. He overshot and before he could zoom the Albatross was upon him. The Hun put a burst through his gas tank and center-section. Luckily someone came along and took care of the Albatross. Rhys-Davids, streaming white vapor, passed into a cloud. Fortunately he did not burst into flames but was able to make a forced landing at a nearby aerodrome.

Now occurred one of the best known air combats of the World War, the victory over Voss, by Rhys-Davids. Major Edward Mannock (better known as "Mick" Mannock), the greatest British ace, who hated all Germans, singly and collectively, respected only two of the German aces. These two were Voss and Boelcke. This is a tribute to be remembered.

At the outbreak of the war, Lieutenant Werner Voss Crefeld—Crefeld was the family name but was not used publicly by him—was a reserve officer in the cavalry. In the middle of 1915 he was transferred to the German air force at his request. A year later he was a member of the famous Boelcke Staffel.

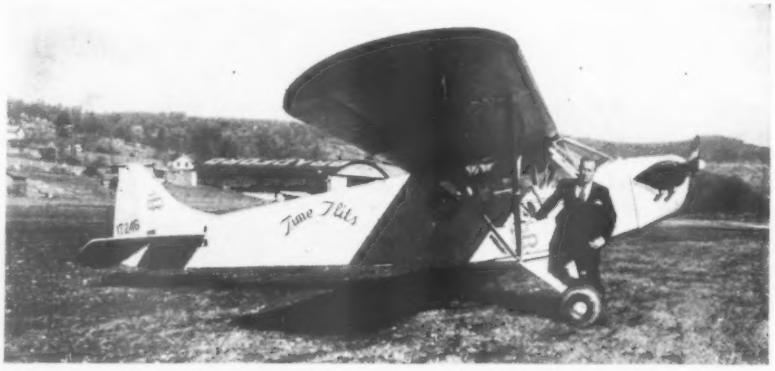
His first victory was a Sopwith Pup which he downed on February 27, 1916. Later this same day he won still another victory. A year later his score was eight. On March 25, 1917, with twenty-two victories to his credit, he was transferred from the Boelcke Staffel and given a Staffel of his own. He was ordered to a quiet sector and remained there for several months.

When he was recalled to the front he immediately began his phenomenal run of

(*Continued on page 68*)

Rhys-Davids as he appeared during the World War—Britain's boy ace.

Commander Frank Hawks Uses "Flivverplane"



Here we have the tiny "Time Flits," the flivver child of Hawks' "Time Flies."

LIEUT. COMMANDER Frank Hawks, who has shattered many cross country records in previous speed flights, took delivery on a Cub "flivverplane" recently. He announced plans to use the Cub extensively on commutation flights about New England and the New York metropolitan area in the future.

For the past year Commander Hawks has been engaged in the manufacture of a new speed plane, "Time Flies." The day previous to taking delivery on the Cub, Hawks made flight tests of "Time Flies" which indicated a top speed in the neighborhood of 400 miles an hour and a cruising speed of 340 miles an hour. During the coming year Commander Hawks plans an extensive program of experimental speed, altitude and cross country record breaking flights.

After gruelling trips at bullet like speed in "Time Flies" Hawks will relax in the little "flivverplane" on flights to his country home in Hawks Nest, Conn. Like a deep sea diver, being de-compressed while coming to the surface, he will slow down by lolling home at the mild pace of 80 miles an hour.

Hawks named the little Cub "Time Flits" after test-hopping it at the Taylor Factory, in Bradford, Pa. He expressed great satisfaction with the little "flivverplane" and was enthusiastic about its utility for commutation flights.

As a running mate for "Time Flies," the Cub "Time Flits," provides an interesting contrast. The steel propeller on "Time Flies" weighs 338 pounds while the total weight of "Time Flits" is 570 pounds.

The Cub is powered with a Continental 40 horsepower motor while "Time Flies" is equipped with a Pratt and Whitney Twin Wasp which delivers 1150 horsepower. "Time Flies" uses 45 gallons of gasoline per hour while "Time Flits" cruises about very well on 2½ gallons. The total gasoline capacity of "Time Flits" is 9 gallons.

The Wibault 283 Transport Used by Air France

AIR FRANCE, the nationally owned airway of France, has adopted the Wibault 283 transport plane as a standard unit in its passenger transportation division. Like many American transports, it is of the all-metal, cantilever low-ing type, bi-motored, but the general design shows the characteristic French outlines that distinguish French planes from those of other countries.

It is interesting to note that transportation statisticians inform us, that about 40 percent of all passengers carried on these transports are American Tourists and that 67 percent are English, American, Dutch or Italian.

The Wibault 283, a favored transport on the Air France which has carried many American Tourists.

Britain's Aerial Ocean Liner

by BERT D. LYNN

What England has done about America's challenge to that famous saying, "Brittania rules the waves!" is told in this article on Imperial Airways' new ocean-flying boats.

WHEN Imperial Airways was formed in 1924, His Majesty's government in the United Kingdom charged it as 'the chosen instrument' of the State with the task of developing air transport on a commercial basis, with the rider that the company should strive to make itself economically self-sufficient.

Imperial Airways was granted, therefore, a subsidy on a gradually diminishing scale as payment for putting into effect the government's air transport programme.

The company has progressed until it now operates, in conjunction with associated companies, trunk lines throughout the Empire.

Speaking in the House of Commons on December 20, 1934, the Under-Secretary of State for Air explained the air ministry's new plan contemplating five services a week to India, three to Malaya and East Africa, and two each to South Africa and Australia.

He added that the time of flight would be just over two days to India, two and a half to East Africa, four to the Cape and Singapore, and seven to Australia. This could only be attained by flying regularly day and night.

To meet the obligations imposed by the new policy Imperial Airways had to embark upon a building programme and as a result placed orders for twenty-nine flying boats and twelve land planes.

The twenty-nine flying boats are being built by Short Brothers (Rochester & Bedford) Ltd., and when in service will be just about the most modern and comfortable craft in the world of their type.

The flying boats, of all-metal construction, are monoplanes of the high-wing unbraced type, with wing tip floats.

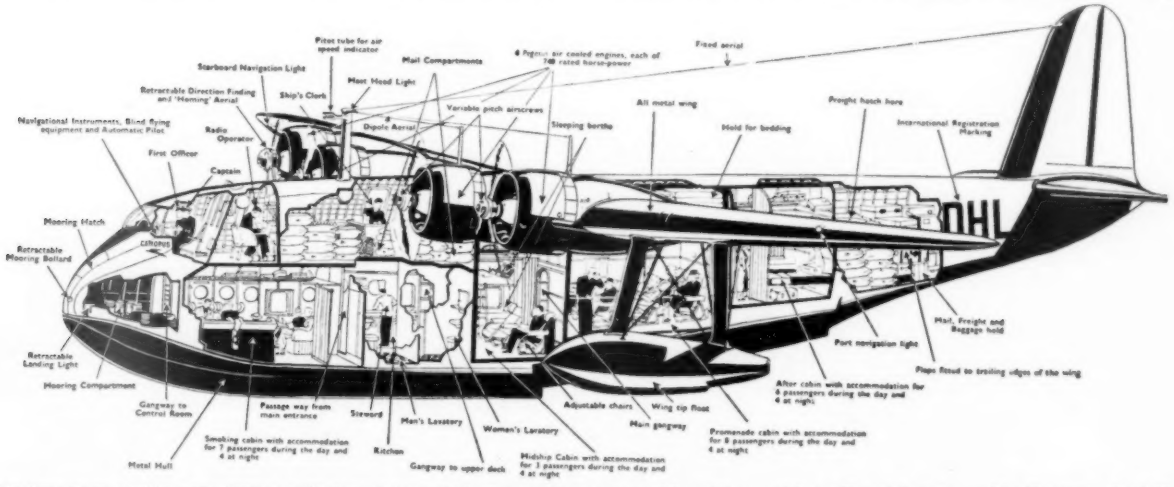
Backed by the British Government, Imperial Airways has launched an extensive trans-ocean long-range flying boat service. The first of these boats, the Short Bros. Canopus, is shown above on a test flight.

Each plane will be equipped with four "Pegasus" air-cooled engines of 740 rated horsepower. The engines, supercharged, are made by the Bristol Aeroplane Co., Ltd. The four variable pitch propellers will bring the top speed to about 200 miles per hour.

The weight of one of these Empire Flying Boats will be nearly 18 tons. Normal payload including crew is about four tons.

Briefly, these new boats are the British counterparts of America's Martin and Sikorsky four-engined aerial Pan American Clippers.

In the forepart of the hull there are two decks. At the forward end of the upper deck is the control room for the Captain and the First Officer. Immediately behind the Captain is the radio room, and abaft that the mail hold with a capacity for three tons of mail. There are arrangements for dealing with the mail during


Pitot tube for air speed indicator
Starboard Navigation Light
Mail Compartments
Fixed aerial
Retractable Direction Finding and 'Homing' Aerial
Mast Head Light
Ship's Clerk
Variable pitch airscrews
All metal wing
Freight hatch here
Navigational Instruments, Blind flying equipment and Automatic Pilot
Radio Operator
Duplex Aerial
Sleeping berths
Hold for bedding
International Registration Marking
First Officer
Captain
Mooring Hatch
Canopus
Retractable Mooring Bollard
Mail, Freight and Baggage hold
Port navigation light
Retractable Landing Light
Flaps fitted to trailing edges of the wing
Mooring Compartment
After cabin with accommodation for 4 passengers during the day and 4 at night
Gangway to Control Room
Passage way from main entrance
Steward
Men's Lavatory
Women's Lavatory
Adjustable chairs
Wing tip float
Main gangway
Promenade cabin with accommodation for 8 passengers during the day and 4 at night
Smoking cabin with accommodation for 7 passengers during the day and 4 at night
Kitchen
Midship Cabin with accommodation for 3 passengers during the day and 4 at night
Metal Hull
Gangway to upper deck

Air travelers of the near future will travel in a style favorably comparable with anything offered by steamship lines—and at 10 times the speed. This cut-away drawing of the Short Bros. Canopus graphically shows what now can be expected of a modern airliner.

flight. On the starboard side of the mail hold is the navigating compartment and the ship's office.

In the forepeak is the mooring compartment. Aft of this is the smoking cabin on the lower deck. Then comes the kitchen; aft of this is the midship cabin, then the promenade saloon, and finally, the after cabin.

The smoking saloon is forward of the main engines and the other three are abaft them. Freight and baggage are stored in a special hold.

So as to make night flying most comfortable the Empire boats have their cabins fitted with beds as well as with chairs. These are the first British air liners to be fitted with sleeping berths.

Accommodations for long distance passengers who have to fly by night as well as by day will be for sixteen, but it will be possible on day stages to take an additional eight passengers. The cabins are very spacious—headroom in some being no less than nine feet.

How these new British boats compare with their American counterparts, the Martin and Sikorsky Clippers of Pan American Airways, can be seen by the comparison, for instance, between the weights of the Canopus and the China Clipper. Fully loaded, the Canopus weighs, as pointed out before, nearly 18 tons. The China Clipper, fully loaded, weighs 25 tons. The Canopus is powered by four 740 horsepower engines as compared to the Martin's four 800 horsepower engines.

Although Imperial Airways officials originally announced the new Short boats simply as additions to that line's vast system of airline schedules between England and her far-flung colonies, it is generally believed that the new British boats are soon to be used on the proposed trans-Atlantic airline between Great Britain and the United States. Pan American Airways has been ready to go to work on the New York-London airline for several months at least, but have been held back by international "red tape." Meanwhile, both the British and American companies are perfecting their equipment and methods so that there will be as little delay as is necessary when the line finally is opened.

After several years of self-satisfied operating with equipment that dated back in modernness to the World War bombers, Imperial Airways and the British government suddenly burst into action after the American trans-Pacific flying boats had been developed and flown successfully. Since that time, British designers and builders have been leaning over backwards to catch up with the United States.

Imperial Airways devoted nearly two years of research to the development of the most comfortable chair for these new flying boats. Every care was exercised to assure that the cabins will be quiet during flight. A special heating and ventilating plant is installed. One of the country's most distinguished decorators designed the inside finish of the cabins. Passengers will be served by the stewards with complete meals from the kitchen aboard.

Each flying boat is equipped with all modern navigational instruments, 'automatic pilot,' 'blind flying' equipment and two-way radio installation.

Private Flying a la 1960

by FRED B. MANN

OH, John, doesn't it look beautiful? Who would ever have thought that we would some day have a plane of our own?

Here, take the old razor blades. I gathered all I could find in the bathroom cabinet. Be careful, don't tear the bag, and don't, for Heaven's sake, sit on them. No, Bobby, you can't sit in front with Daddy. You and I'll have to sit back here with the lunch and watch Daddy fly the plane.

No, your parachute is not too tight! I fixed it on you myself and I ought to know—please fly slow, John. You know how reckless you are. . . . Look, Bobby, there are The Oranges! Not fruit, silly—they're towns in New Jersey. . . . How strange, John! New Jersey's the same color as New York, but they're different colors on Bobby's geography map.

Look out, you nearly hit that other plane! You did, too! There's plenty of air on both sides. You don't have to be afraid of going into a ditch up here. I know you're flying the plane. That's why I'm so jittery.

Philadelphia? Already? Isn't it quiet looking, even for a Sunday? Here's Washington, Bobby. Look out, John, you just barely missed that monument! Well, suppose it is Washington's; is that any reason why you should hit it?

Bobby, I won't wipe your nose again. I already have, twenty times. Stick your nose out the window and let the wind dry it. . . Pittsburgh? Is it Pittsburgh, John? All those high stacks make me nervous. If we had to parachute and crossed our legs, we'd be apt to go right straight down inside one of those chimneys.

Ohio? It's Ohio, Bobby, daddy says. No, we can't stop to see Aunt Clara and Eddie. She wrote me they were flying to Cuba today.

Over Chicago in ten minutes? Now, John, please be careful to fly high over there, so we won't get hit by any gangsters' bullets. Look, Bobby, that's the Mississippi and there's St. Louis. I met a lady from St. Louis, last summer, when we were in Atlantic City.

Did I tell you about her, John? She claimed her appendix scar was longer than mine and when I told her it simply couldn't be, she said she was from Missouri and would have to be shown. So when we were dressing to go bathing, I showed her—and my scar was the longer. She hardly spoke to me after that. What, Kansas?

Really, John? Mr. Landon was a nice-looking man, anyway. Look, Bobby, daddy says we're nearly over the Grand Canyon. Oh, John, don't dip so low! Well, you missed it with the razor blades. I knew I should have thrown them at it. When I

(*Concluded on page 67*)

The NATIONAL AIR BOARD Says— *Unbiased Opinion to Further National Aeronautics*

MEMBERS OF THE BOARD

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Ray W. Brown
Douglas Campbell
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William C. Fleming
Betty Huyler Gillies
Randolph F. Hall
C. S. (Casey) Jones
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Augustus Post
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James B. Taylor, Jr.
D. W. Tomlinson
William Van Dusen
E. Burke Wilford
R. C. Wood (Paris)

ALEXANDER KLEMIN, CHAIRMAN

THE Air Board had an interesting guest at its sixth meeting—Mr. Sidney B. Veit of Paris, for a great many years representative of the National Aeronautic Association with the Fédération Aéronautique Internationale.

It was a privilege for members of the Air Board to get first hand information on European aircraft conditions in general and on the proposed trans-Atlantic race in particular.

GREAT BRITAIN BUYING AMERICAN PLANES

Mr. Veit told the Board that both England and France were profoundly aware of the menace of air warfare, were building or undertaking to build large number of aircraft, constructing underground bomb-proof shelters and in every other way preparing for this danger.

Representatives of Great Britain have been visiting American factories and placing large orders for fighting aircraft. The reasons for English purchases of American equipment are twofold.

1. Because their military authorities wish to increase the source of supply for reserve matériel.

2. Because England is enjoying an industrial boom and does not wish to divert too many of her industrial plants to war use.

Whatever the reasons, our American constructors can only be congratulated on this new and welcome business.

BATTLESHIPS VERSUS BOMBERS

Quite recently the British Committee on Imperial Defense after a very thorough study of the subject had unanimously recommended the building of two new battleships instead of an additional number of airplane bombers. The first newspaper cables received were rather disturbing to aviation people. But later cables cleared up the situation satisfactorily.

First of all the technical experiments conducted in great secrecy have definitely proved that no battleship is in existence or can be designed which is impervious to air attack. Even if the requirements of speed and armament were disregarded the most heavily armed battleship could still be destroyed or at least seriously crippled by a determined and powerful attack from the air.

In the United States, the findings of the committee would therefore seem to indicate that we should build more bombers rather than more battleships—particularly as one battleship costs about as much as 43 twin engine medium size bombers. The British, however, have a different problem from ours and they have to patrol all the oceans of the world for the safety of their merchant marine.

In their case the compromise between battleships and bombers probably should lean a little more in favor of the battleship than with us. That was the sole significance of the decision of the Committee on Imperial Defense.

One of Great Britain's giant aerial ocean liners in test flight.

AIR CORPS FULLY ABREAST OF PARACHUTE TACTICS

Readers may perhaps remember the Air Board's comment on the Russian military maneuvers in which a force of men armed with machine guns was flown behind the enemies lines and successfully released.

Inquiry from the Chief of Air Corps elicited the information that our own air service is perfectly aware of this technique and was in fact developing such technique as early as October, 1929. Thus, in a demonstration given in 1929 at the Primary Flying School at Brooks Field, two machine guns were dropped in parachutes and put into action by two crews of three men each who descended from the airplane to the ground via the parachute route.

The machine guns were assembled and prepared for firing in a few moments. The demonstration featured a special machine gun parachute bag developed by Sergeant Erwin H. Nichols. The parachute supporting the bag opens automatically upon being thrown from the airplane and floats to earth. The bag containing the gun, ammunition and a gallon of water for use in cooling, can be quickly opened on the ground by means of a rip cord similar to that on the parachute. Several other technical demonstrations of this character have been made at Brooks Field.

Captain Depew summarized the situation by saying that the Russian aircraft authorities evidently understood publicity a good deal better than our Air Corps, which probably valued military secrecy more than advertising.

NO MORE AIR MAIL PILOTS

During the discussion a member of the Board referred to air mail pilots. Dean Smith pointed out very cogently that there were no more air mail pilots and that there were only transport pilots. The airways are rapidly becoming self-supporting and the carrying of the mails is becoming with them just as much of a subsidiary matter as the carrying of mails is to the railroads.

It is the aim of operators to be able to operate with any so called subsidy. As a matter of fact there is no real subsidy at the present moment because the transport companies give the Post Office Department full value for payments received.

The policy of the government should now be not to interfere with transport operation but to give it all the support possible. Not only is such support justified on the score of industrial development, but on the ground of national defense. Mr. Dean Smith said that at least one-half of the pilots engaged in air transport are flying reserve officers and constitute a splendid body of men to draw upon in case of war.

THE FIRST TRANSCONTINENTAL FLIGHT

No one is better informed on the history of pioneer aviation than Augustus Post. Mr. Post most appropriately drew the Board's attention to the Early Birdmen dinners held on the 4th and 5th of November in New York City, Chicago, and Los Angeles in commemoration of the first

transcontinental flight. This was carried out by Caldraith P. Rogers in 1911, using a Wright biplane.

To earn a small prize, Rogers flew from New York to San Francisco in 48 days—*48 days, not 48 hours.* The maximum speed of the plane was 40 miles per hour. The historic transcontinental flight was punctuated by crack-ups. The machine was actually rebuilt two or three times in lonely spots. The longest flight achieved in any one day was 200 miles. At the end of this historic feat, Rogers attempted the graceful gesture of dipping a wing tip into the Pacific Ocean near Los Angeles. He dived, dipped a wing, nosed over and perished. The world does move!

AVIATION LEGISLATION BY THE STATES

There has been a great deal of legislation by the States in regard to aviation. Some of it has been good, some bad, some indifferent. Though discussing no particular laws, the feeling of the Air Board in regard to State legislation was somewhat as follows:

State legislation should not duplicate the regulation, licensing and inspection of aircraft and personnel by the Federal authorities. Such duplication of effort would be an intolerable burden to commercial aviation. Further, there should be no attempt to lay special taxes on the aviation industry so as to provide well paid political jobs.

If State effort in aeronautics is undertaken this should be done with a view of fostering new airports and the laying out of local State airways, and State effort should be in skilled hands. It has been suggested that State troopers might inspect aircraft and licensed personnel. Would they be qualified for such work without a great deal of preliminary training?

Captain Depew and Mr. William C. Fleming were asked to make separate studies of this subject and to present their findings to the Board for further discussion.

CONGRATULATIONS TO VINCENT BURNELLI

On the suggestion of E. Burke Wilford, congratulations of the Board were extended to Vincent Burnelli on the licensing of his principle in England where active construction of military and commercial planes embodying the Burnelli principle is in process. It is indeed gratifying to learn that this principle has received international recognition.

AUTOMOBILE ENGINES FOR FLYING USE

As is well known, many flights have recently been made with automobile engines converted to aviation use. Randolph F. Hall suggested this as a topic for discussion. Dean Smith referred to the work of the Funk Brothers of Akron, who bought used parts for $165 and made Chevrolet and Essex engines into acceptable aviation power units of about 80 horsepower.

Mr. Wilford thought that such efforts would at least have the tendency to bring down the prices for low power aircraft engines. Captain Depew pointed out, however, that the use of automobile engines with their greater specific weight was not a complete solution of the problem, nor was the attempt in any way novel. Way back in 1920 Horace Kean had flown a single

(*Concluded on page* 70)

The Grumman Single-Seater Fighter

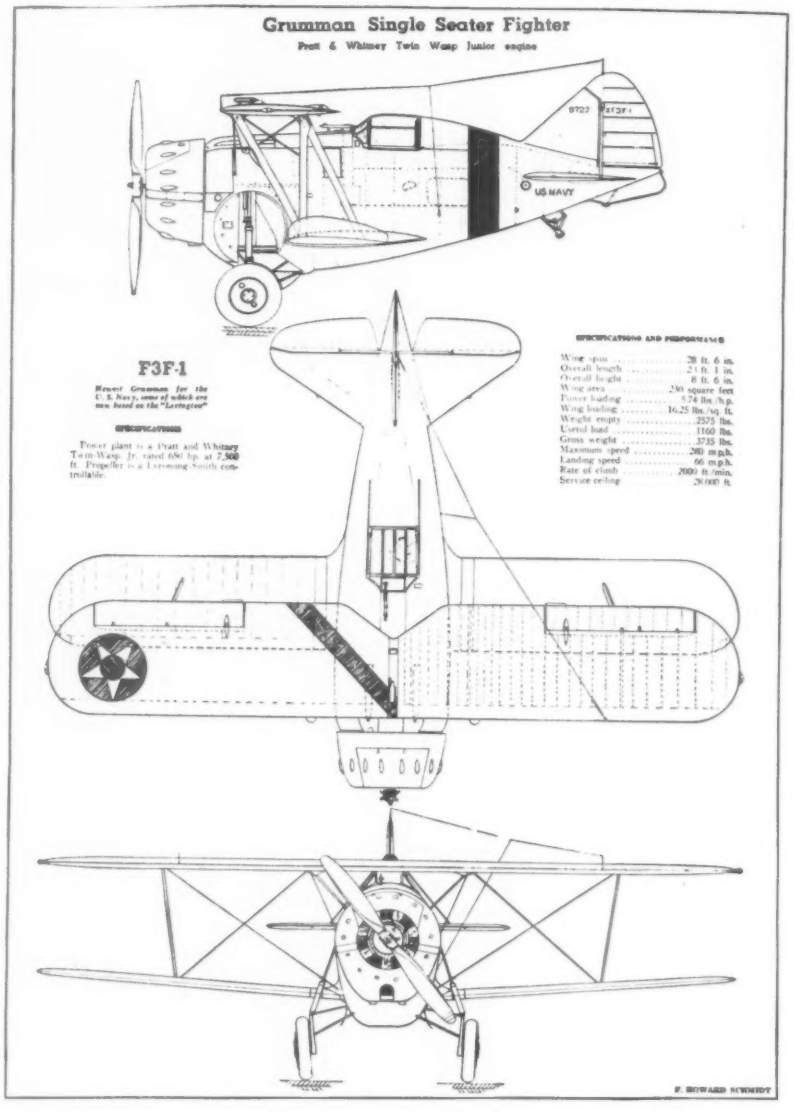
(See our front cover)

IT is not difficult to distinguish Grumman fighters from other makes and types of fighters because of the characteristic chubby fuselage and its distinctive outlines. In part, this is due to the type of landing gear peculiar to this ship which folds up against the sides of the fuselage and which effect is augmented by the cockpit enclosure.

In colors on the front cover of this issue, and by the line drawing below, we show the Model F3F-1 equipped with a Pratt and Whitney Twin Wasp Junior engine rated at 650 h. p. The other Grumman fighter models are the F2F-1, the F3F-2 which is equipped with a Wright Cyclone "G" engine, and finally, the FF-1 fighter.

Composite construction is followed: fabric covered aluminum alloy wings, a dural monocoque type fuselage and all fixed control surfaces of dural. Movable control surfaces are fabric covered dural frames. The landing-gear is retractable and of a type particularly adapted to deck landings in shipboard service. The biplane wing arrangement permits of a compact arrangement of the main lifting surface, necessary on shipboard.

A top speed of 280 m. p. h. with a climbing rate of 2,000 feet per minute, together with a ceiling of 28,000 feet shows the tremendous capabilities of these small planes which are hardly larger than an ordinary amateur lightplane. The performance is indicated by the power loading of 5.74 pounds per horsepower. The landing speed of 66 m. p. h. is indicated by the wing loading of 16.25 pounds per square foot. The color scheme and characteristic insignia are shown faithfully on the front cover.


Grumman Single Seater Fighter
Pratt & Whitney Twin Wasp Junior engine
US NAVY
F3F-1
SPECIFICATIONS AND PERFORMANCE
Wing span 28 ft. 6 in.
Overall length 21 ft. 1 in.
Overall height 8 ft. 6 in.
Wing area 281 square feet
Power loading 5.74 lbs./h.p.
Wing loading 16.25 lbs./sq. ft.
Weight empty 2575 lbs.
Useful load 1160 lbs.
Gross weight 3735 lbs.
Maximum speed 280 m.p.h.
Landing speed 66 m.p.h.
Rate of climb 2000 ft./min.
Service ceiling 28,000 ft.

"....Clear and Unlimited"

by SWANEE TAYLOR

Our versatile commentator, in his highly interesting and entertaining manner, makes pertinent remarks concerning doers and doings in aviation.

SOME while back I wrote an open letter to Colonel J. M. Johnson, Asst. Secy. of Commerce, asking that the U. S. Coast and Geodetic Survey do something about putting maximum ground elevations on all airways maps. Upon receipt of his copy of Popular Aviation Col. Johnson moved with characteristic promptness and thoughtfulness to take it up with the proper people, and just as promptly relayed their findings back to me.

Sad to say, I'm not particularly happy about the Coast and Geodetic Survey report. Nor can I clap hands with glee over Col. Johnson's matter-of-fact, " . . . they submitted the enclosed memorandum which clarifies the matter very completely." Somehow I wish the Colonel hadn't been so calm in his acceptance of C. & G. S.'s demure admission of failure.

Here in substance, is what the Acting Director of C. & G. S. reported: (a) That my request that mountain tops be vividly shown on the charts comes as a valuable but very obvious suggestion. Hmmm, valuable and obvious! It's nice to know that they are aware of the necessity.

(b) That their bureau is constantly improving the airways maps, but an acute shortage of manpower, plus an increasing demand for these charts has them slowed down to a walk. I wonder if it ever occurred to anyone in that august body that a couple of men might well be spared from dabbling around with charts of harbors and inland waters to pinch hit on airways maps!

(c) That a pilot must be dumb indeed if he can't tell how much mountain is sticking up in the soup by looking at the gradient markings on his map. Let me quote: "The existence of a 2,000-foot contour and the absence of a 3,000-foot contour do not indicate, as inferred by Mr. Taylor, that 2,000 feet is the maximum altitude. On the contrary, the elevation inside the 2,000-foot contour may be anything greater than 2,000 feet and less than the next contour elevation; that is, it may be as great as 2,999 feet." That's just the point. Remember the ship full of people that missed getting over the mountain by *exactly 27 feet?* Merciful Heaven, it would be exceedingly worth while to knock-off everything else in C. & G. S., to bring the airways maps up to date. Human life, whatever else C. & G. S. may think, is far more important than how many fathoms of water are to be found in Cuttyhonk Creek, Nevada.

Yes, plain to see our Coast and Geodetic Survey is completely out of step with aviation—diligent enough but not in *tempo.* Mayhap, when Colonel Johnson gets some reaction to this he will set machinery in motion to get us an entirely new layout of maps made from the air. Possibly he will even take immediate steps to have the airways mapped by stereoscopic cameras. Knowing the man I'm inclined to believe that he will whether you write or not; he's both practical and visionary and he's sold wide-out on aviation.

Swanee Taylor, commentator—both columnar and radio—extends his greetings.

I Told You So . . .

This department went on record, upon the first coming of the *Luftshiff Hindenburg* to this country, with an opinion that public agitation would soon start for more and bigger dirigibles. My forecast was that after a spell of busy undercover lobbying, in official Washington, the build-up would begin; a huge build-up which would earn eventually a juicy contract for the Goodyear-Zeppelin Corporation.

Now comes an Associated Press dispatch from the capital nicely twisted so as to convey the impression that the Bureau of Aeronautics "urges" a program of new big dirigibles. Well, scallions to the AP writer, who either by accident or design, so misrepresented the content of the Bureau's annual report. I have a copy of this report on my desk and I assure you that only the merest mention is made of the former chief's negative, at best, recommendations for lighter-than-air development. Personally I prefer to think that the piece is bad reporting which, in itself, is sufficiently deplorable in these days of clear cut, accurate journalism.

Of course, if any investor elects to sink his dollars in a strictly commercial airship or two it has to be all right with me. A man earns along with his dollars the right to do with them as he sees fit. George Washington threw one of his across the Potomac. Besides, airships might very well turn out to be good freight carriers some day.

But if any big corporation, Goodyear or anybody else, tries to foist another Big Blink upon the taxpayers of this country, that big corporation will meet stubborn opposition here. For, it has been proved time and time again (on Fleet maneuvers), that the old rubber pigs can't even survive in theoretical warfare.

Bird-dog . . .

A sharp clash between the old and the new; a wrenching twist between instinct and environment came to light recently in the wistful tale of Pat, a golden brown Irish setter, owned since puppyhood by Maj. Sasha de Seversky, the old airplane builder from the banks of the Volga.

Pat is a handsome, well-bred young fellow but he was exposed to aviation while still young enough to be carried in his master's flying suit pocket. And, I tell you, it left its mark. Today when he hears a ship in the distance he dashes out of the building to "point" the oncoming sound. The distressing part is when the ship passes directly overhead. Then, true to his canine heritage, Pat's sharp muzzle follows the line of flight until onlookers fear that his neck will go out of joint. But, and here is where environment comes in, just at the proper moment the dog executes a beautiful split-S turn and tears off across the greensward in hot pursuit.

Memo to David Sarnoff . . .

Now that congratulations are in order for NBC's Tenth Anniversary, let me join belatedly in the swell of voices singing your praise. It has been an unbelievably grand job you've done, sir, and few people realize more fully than I just how much program broadcasting has moved ahead in the last ten years. But let's you and I peek for a moment into the next decade; let me from my perch of professional experience point out the aviation picture which is fast fading-in through the haze.

You'd be astonished, Mr. Sarnoff, to know just how very prophetic you were several years ago when you told John Hays Hammond that flying and radio were insolubly linked. Not only has wireless transmission of signal been our salvation, but, too, we have contributed vastly to radio broadcasting. Look, for proof of this, at the NBC Anniversary publicity release. Aviation is prominently featured, having fourteen mentions in that catalogue of outstanding programs. This is considerably more than any other two classifications including sporting events.

As for the future, see if you can catch these faint tracings of what aviation tomorrow will mean in our contemporary life. I honestly believe you will, and will

XUM

take prompt steps. Right now, esteemed sir, there are roughly between ten and twelve millions of humans in this country who are avidly interested in the subject of flying. The age range is from seven to seventy, with about half that number over sixteen. Why, man alive, there are half again as many high schools in this country with aviation activities (clubs, courses, etc.), as there are motion picture theaters. There is a rootin' tootin' ready-made audience for you, right within easy reach.

Nor is aviation kid stuff any more. The kids have grown up in the last six years and they are young men and women voters now. (Remember November.) And they constitute a considerable market. Yes sir, that's why commercial aviation has grown steadily, in graceful leaps and bounds all through the depression.

Isn't it about time, then, for NBC to operate its own division of aeronautics? Let me nominate Jules Herbuveaux, in your Chicago headquarters, to organize and run such an enterprise. He is a cracker-jack, practical flying man and he knows radio broadcasting. Witness, please, his "Flying Time," the only consistently good aviation program ever on the air.

Also, the National Broadcasting Company might do well to present twice-weekly digests of the flying news. You know, a sort of aerial Boake Carter who will entertainingly dish up red hot news and gossip for the growing army of flying fans. That would be looking into the future! But are the steel trap minds (tightly shut) in your program department quite up to the task of squinting beyond next week?

Anyhow, once more my congratulations, together with a fervent wish for ten more years of happy landings—may they be smoother and smoother.

The Armistice . . .

It has always been, and will always be, the policy of this magazine to encourage discussion of matters aeronautic. Our pages are open to any man, woman, child who comes forward with a germ of an idea which, in the orderly process of debate, may lead to lasting benefit to our Beloved Flying. But, for the sake of our milder mannered readers, let's everybody know what we are talking about, and don't let's bite in the clinches.

Lamentably, quite some personal heat crept into the recent pro and con discussion of the Hammond plane, with the result that it became pretty much a childish squabble. To be sure, I was responsible for the brawl inasmuch as I lashed out first against Max Karant's stinging blanket indictment of the Aircraft Industry. And after I'd put my foot in my mouth we simply had to let Karant have his precious last word.

EDITOR'S NOTE. *And what a relief it is to have peace restored once more with the dove and olive branch in the ascendant! We got out of the trenches by Christmas and this is something, believe me.*

As to me—I'm perfectly neutral, let the chips fall where they may, and all the rest of it, but I'm sure glad to witness the termination of hostilities.

H-a-p-p-y Landings

REMEMBER when the approach of a pilot was something like the coming of a comet? Shiny leather pants, goggles and helmet always conspicuous, just to show that here was one of those daring young men.

Well, the other day, a well dressed party was wandering around our home port. Might have been a doctor or a dentist or a successful manufacturer of dog food.

After telling him a few things about flying airplanes we found out he was . . . one of the Navy's Hell Divers . . . it's getting so you can't tell . . . and the guy you try to sell an air lane may trade you sky hook for it.

* * *

Papa Robin: "Hey! Haven't these kids flown yet?"

Mama Robin: "No, dear. We have to wait for a Department of Commerce inspection."

* * *

FLYING backwards is no longer a stunt; it's a nuisance. Take some of these lightplane jobs with a wing that would hold up a bomber, head them up into a spanking stiff wind and while the little motor labors strongly watch the scenery slide by . . . in reverse.

* * *

Old Maid Aunt: "Now, John, I'm going to be here all the afternoon and you can ask all the questions you want to. Go ahead, child."

Little John: "Hey, Aunty, what's the wing loading of the new Kinner jobs?"

* * *

Among our summer pests: Those innocent wide-eyed young ladies on vacation who hang around airports looking wistfully at pilots, at planes, at the sky and saying "It must be wonderful to fly." And of course the profession is so dignified that no pilot ever thought of taking advantage . . . .

* * *

Silly Sal: Oh! I'm disappointed.

Friend: How come?

Silly Sal: Well, I came down here to see this wonderful flying field I've heard so much about, and it stands perfectly still!

* * *

Aeronautics Prof.: I've been teaching men to fly for the past ten years and I've

(Concluded on page 65)

"Yeah—I'm Michael Angelo—so what, you damned Sparrow?"

Making Towed Glider Flights

by F. HOWARD SCHMIDT

Here, by illustrations and by words, is a graphic glider flying lesson. In this particular case, towing by automobile is employed for getting the glider into the air.

HUNDREDS of young men in this country interested in aviation are learning how to fly with the aid of that simplest of all heavier than air vehicles, the glider.

Glider clubs are being formed here and there throughout the country and are soon filled to capacity with members. Any young man who has an earnest desire to fly but has not sufficient funds with which to secure ordinary flying lessons can receive the basic instructions in the fundamentals of aviation by taking up gliding. A glider student has been known to fly an airplane after only one hour of further instruction.

Let us look further into one of these glider clubs and see how they operate. We'll take the case of the Waukegan Gliding and Soaring Club which has its headquarters at the Kenosha Airport in Southern Wisconsin.

In the fall of 1935 four young men purchased an old broken down glider which had been in a crackup. During the winter months this glider was completely torn down and reassembled. During this period of reconstruction other young men became interested in the experiment and a club was formed.

The finished product was a primary glider with a wing spread of 36 feet and a length of 19¼ feet. In weight it does not exceed 170 pounds due to the light construction of the framework which was built mostly of one inch tubing. The cost of the entire finished glider was only $125.

From the humble beginning of four members last fall this club under the expert guidance of Clas Idstrom has increased its membership to fifteen. Bill Peachman who is the flying instructor for the club has eleven years of flying experience. With the increased membership the club is planning to construct a secondary glider for the more advanced students, and in the near future a soaring glider is going to be constructed.

Regular flights are made in the evenings and on Sunday mornings when the weather permits.

The pilot is strapped in the open seat of the glider and is then hauled into the air behind a fast moving automobile. A tow rope of about 900 feet is used. After reaching the desired height the pilot releases the rope and glides to the ground.

The ability of the pilot determines the length of time he can remain in the air. This particular glider has been kept in the air for 3½ minutes and due to its stability has been landed with the hands off the controls.

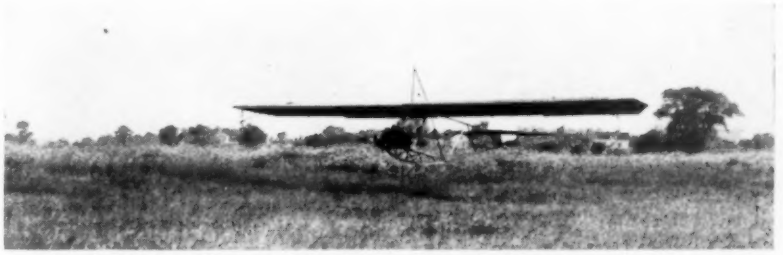
Where the terrain is better adapted to gliding, or where there are suitable slopes and hills, the distance and duration of the glide can be very greatly increased or soaring can be indulged in by the pilot.

Four Stages in Glider Flight Instruction

1. Members of the Waukegan (Ill.), Gliding and Soaring Club making the final arrangements before the towed flight is started. The members of the club built this primary glider.

2. Just before the start. The car driver is watching for the signal from the glider pilot. Upon receipt of the signal, he will start the car.

3. The take-off. The glider starts climbing at a steep angle, and after the desired altitude is reached, the tow rope is released and the true glide begins.



4. Coming in for a landing. The pilot has leveled off and is coming in against the wind so that the ground speed is reduced to a minimum.

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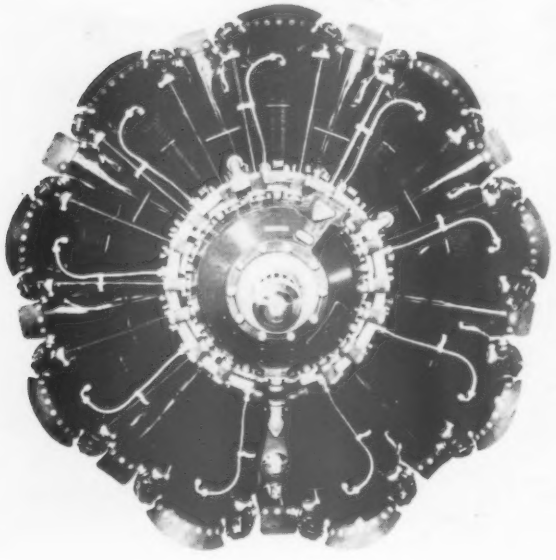
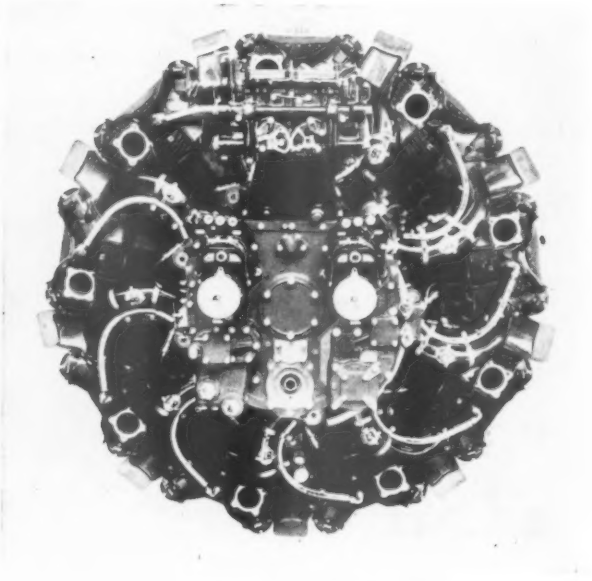
Detailed Description of the



A head-on look at 1,000 horsepower.



Rear view of the Model G Cyclone.

FOR several months past, the spotlight of public attention has been focused on the new 1,000 H.P. Wright Cyclone.

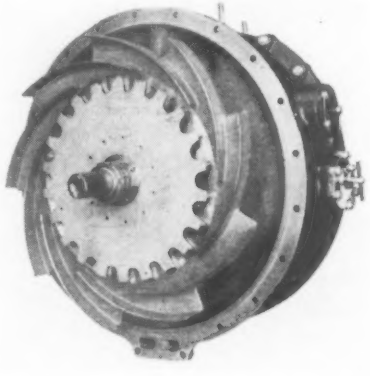
Selection of the Cyclone to power all of the new Douglas and Boeing bombers ordered by the U. S. Army Air Corps, the decision of American Airlines again to choose Cyclones for its new fleet of Douglas Flagships, and the record breaking flights of Howard Hughes and General Frank M. Andrews of the G.H.Q. air force, have created a world-wide interest in this engine.

The formal announcement of the "G" Cyclone marks the tenth anniversary of the inception of Cyclone development. Ten years ago, the Wright Aeronautical Corporation designed and developed for the U. S. Navy a nine-cylinder engine of 400 H.P. to supplant the war-time Liberty engines in Naval patrol boats. This engine, known as the Wright P-2, was the forerunner of the current Cyclone series.

A comparison of the characteristics of the "G" Cyclone with those of the "P-2" forcefully brings out the advances which have been made during the past decade. The 1,000 H.P. take-off rating of the new Cyclone represents an increase of over 100 per cent in power output alone. During the same period weight has been reduced from 2.03 pounds per horsepower in the "P-2" to 1.07 in certain advanced Cyclone models despite the fact that the total engine weight nearly has been doubled.

One of the most outstanding attributes of the "G" Cyclone, second in importance only to its combination of high power output and reliability, is its low fuel consumption. The Diesel engine has been the type of powerplant most generally used for fuel consumption *contrasts*. With a specific fuel consumption of only .43 pounds per brake-horsepower hour, the new Cyclone is the first radial air-cooled engine which can be *compared* favorably with the Diesel.

In the design and construction of the "G" Cyclones are found many new and improved features, the most outstanding of which is the new type of cylinder which has a total cooling fin area of 2,800 square inches. Advances in technique in the Wright foundry, largest of its type in the world, have enabled Wright engineers to produce a cylinder head with cooling fins spaced as closely as the teeth on a woman's comb. The cooling area of the nine cylinders of the engine is approximately 175 square feet—the equivalent of the floor space of a normal room or office. Other outstanding features are automatic lubrication of the valve gear through a built-in system, a new type of finned spark plug, full pressure baffling, improved induction system, the dynamic damper counterweight which removes torsional vibration, forged pistons, a simplified and easily accessible accessory section provided with drives to meet all of the requirements of modern military and civil transport service, and improved oil sealing.



Vaned diffuser plate and the 11-inch diameter impeller of the new Cyclone's supercharger.

The principal controlling and limiting factor in the progress of aircraft engine performance, both in relation to power output and to economy in fuel consumption, is the control of cylinder temperatures.

Recent advances in foundry technique have made practicable the production of cylinder heads with cooling fins of unprecedented depth and close spacing, with the result that the heads of the "G" Series Cyclone engines have nearly double the effective cooling area of previous models. The total effective cooling area of the "G" Series Cyclone cylinder is approximately 2,800 square inches (1.8 square meters) per cylinder, making a total of 175 square feet (16.25 square meters) of cooling fin area on the engine as a complete unit.

This is the equivalent of the floor space of a normal room or office. Especial attention has been given to distribution of the fins to provide uniform cooling over the entire combustion chamber, including the spark plug bosses and the exhaust valve seat, and fins have been carried high up on both the intake and exhaust valve regions.

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New Model 'G' Wright Cyclone

Air deflectors (or "baffles") of improved design are provided to give a more effective use of cooling air and increase the velocity of air flow over the cooling fins. Closer fitting of air baffles has reduced the total area of the cooling air passages approximately 35 per cent to give a present total area of 1.6 square feet (.148 square meters).

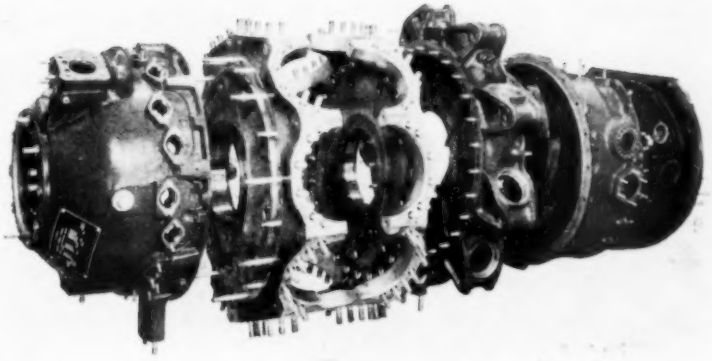
Great care has been given to the control of spark plug temperatures—always a potent source of detonation in high output engines. The "G" Series engines carry a new type of finned spark plug which is provided with longer threads, greater heat dissipation areas and improved electrical construction.

The material reduction in temperatures thus realized not only minimizes the influence of the spark plug as a source of detonation at high outputs or at low fuel-air ratios, but minimizes also difficulties from lead deposits on vital electric parts and greatly increases the life of the spark plugs and the periods between normal removals for inspection and adjustment.

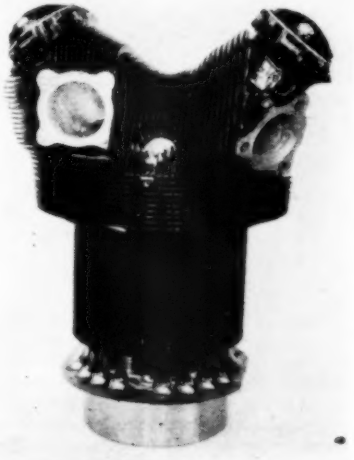
Intake and exhaust ports are located at the rear of the cylinder head as in previous engines. The valves, valve springs, and valve rocker arms are completely enclosed in supporting boxes which are cast integrally with the cylinder head, the valve being continuously lubricated by an automatic lubricating system supplied by the main engine lubricating system.

The cylinder assembly is built up of forged nitralloy cylinder barrels which are screwed and shrunk into the cast aluminum alloy cylinder head. The internal surfaces of the cylinder barrels are nitrided to give a glass-hard surface case, which minimizes piston scoring and seizure and more than doubles the service life of the cylinders.

While in general the induction system of the "G" Series Cyclone is of the same distinctive design as that of the preceding "F" Series engines, numerous refinements and improvements have been introduced in the "G" Series to reduce the internal resistance to gas flow, to improve volumetric efficiency, and to provide for the larger volume of combustible gas required by the increased output.



Relative positions of the six crankcase sections which hold the "G" Cyclone's moving parts together. From left to right are the nose section, the two halves of the main section, the cast aluminum mounting and supercharger sections and the magnesium accessory section.



Rear view of a Model G Cyclone cylinder.

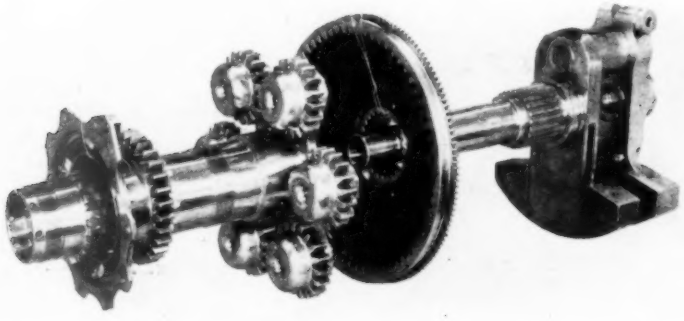
The "G" Series Cyclone is equipped with a downdraft carbureter of the general type introduced on radial air-cooled engines as standard equipment for the first time with the Cyclone "F." This type of carbureter has the advantage of taking air directly to the carbureter from a position above the engine nacelle where it is free from dust or water-spray.

The result is that the induction passages are shorter than is the case in the older, more conventional type and the installation is simpler and lighter. An improved model of carbureter having materially increased capacity has been introduced for the new "G" Series Cyclones.

A finer adjustment of the fuel-air ratio than has heretofore been possible has been achieved by the provision of an improved mixture control. The new arrangement is such that the effective travel of the mixture control lever has been increased and a greater effective travel of the mixture control lever is required for a given change in mixture strength. The result is that the sensitivity of the mixture to small changes in position of the control lever is reduced and a finer and more positive control is thereby provided.

To the mixture control has been added a device which instantaneously cuts off the fuel supply to the carbureter jets, thus stopping the engine quickly without danger of backfiring. When the mixture control is moved to the stop at full lean position, the fuel flow through the carbureter jets is cut off by the creation of a suction in the float chamber equal to the suction at the discharge nozzles. The float chamber, accordingly, remains filled with fuel ready for subsequent starting.

An automatic control mechanism for maintaining constant induction manifold pressure is provided in the throttle control system. A control is provided in the cock-



This photograph shows the design and construction of the Wright system of reduction gearing. This is the dynamic damper-equipped Cyclone crankshaft and the components of the 16 to 11 propellor speed reduction unit.

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pit so that it may be set by the pilot either to the specified normal operating pressure, or to the emergency or take-off pressure.

The supercharger of the "G" Cyclone retains the general form which has proved so successful with the previous "F" Series Cyclone, whose distinctive features are—

(a) An unusually large impeller of 11 in. diameter in place of the smaller diameter impellers used in conventional practice. The adoption of the larger impeller greatly reduces the rotative speed of the supercharger impeller with consequent improvement in the life of bearings and driving mechanism.

(b) With reduction in rotative speed, the ball bearings required by the very high rotative speeds of small diameter impellers have been eliminated. The conventional arrangement of extremely high rotative speeds with ball bearings has always been a source of much difficulty. A flawless record of performance with hundreds of Cyclone engines in severe service has amply demonstrated that these difficulties have been completely eliminated with the adoption of plain bearings in combination with the lower rotative speeds of the large diameter supercharger impeller.

(c) The design of the supercharger driving mechanism permits the interchangeable installation of optional sets of driving gears to give any desired ratio of supercharger-to-crankshaft speeds over a wide range. Any one of the desired gear combinations can be installed in the field without any other change in the engine or any of its parts, thus permitting the adoption of a standard engine type to all classes of operating service, ranging from heavy duty airplanes whose normal field is at low altitude to high performance airplanes requiring a high degree of supercharging at high altitudes.

In the "G" Series Cyclones the area of the inlet to the supercharger has been enlarged corresponding to the increase in the carbureter throat areas and increased capacity of the engine, and there have been incorporated numerous refinements in contours and increases in dimensions of diffuser vanes and passages to improve capacity and efficiency.

Six optional impeller speed ratios are available for installation, ranging from 5.95 to 10 times crankshaft speed, with corresponding power characteristics as given on current published characteristic sheets.

Exhaust and intake valves are forged from special heat resisting steels, adopted as a result of extensive tests. For the rapid conduction of heat away from the exhaust valve head, the valve head as well as the stem is filled with metallic sodium which liquefies under ordinary operating temperatures.

The reciprocating action of the valve causes the sodium to surge up and down carrying heat away from the head of the valve into the valve stem, whence it is dissipated through the valve guides to the external cylinder fins.

In addition to the reduction of valve temperatures, valve life has also been extended by facing the exhaust valve with stellite and by the use of stainless steel exhaust valve seats, both of which are highly

(*Continued on page* 64)

Parks Adds a Monocoach to Its Fleet

Parks Air College's new twin-engined Monocoach trainer.

BRINGING the number of its flight training planes to 12, Parks Air College is adding this new "Monocoach" to its "line." It is for the use of Professional Flight students in their advanced training.

Everywhere it has been shown, the Monocoach, often referred to as the "baby transport," has elicited favorable comment because of its resemblance, except for size, to the bimotor transports that have become standard equipment on the larger air lines.

It is equipped with landing and navigation lights, two-way radio, instruments necessary for blind flight, retractable landing gear and wing flaps. Delivery will be accepted as soon as the Approved Type Certificate is secured by the manufacturer, the Monocoupe Company, from the Department of Commerce.

Standing before the plane is George J. Gruen, Head of the Parks Air College Flight School and Instructor in Advanced Flight.

It's Northwest's 10th Birthday

NORTHWEST AIRLINES, one of the four major east-and-west trunk highways of the sky—which is celebrating its tenth anniversary—has many "firsts" to its credit in the history of air transportation.

It was the first company in the United States to establish a coordinated air-rail passenger service. This was begun in September, 1928, with the cooperation of four of the nation's greatest railway systems—the Northern Pacific, Chicago, Milwaukee, St. Paul and Pacific, Great Northern, and the Pennsylvania.

By means of this service, passengers were afforded the fastest transportation available, transferring from planes to trains and vice versa. This operation was supervised by a technical committee headed by Col. Lindbergh, who inaugurated the service by making the first flight over the route in one of the two trimotor Ford ships that Northwest Airlines had purchased at a cost of $65,000 each.

Northwest has always been a pioneer in the use of modern planes. Even when the line first started, it was equipped with a fleet of the fastest passenger carriers in the air at that time—Hamilton cabin monoplanes of all-metal construction, powered

(*Continued on page* 54)

Can You Fly a Lightplane?

We don't recommend that you fly with a book in one hand and a control stick in the other; but we do recommend that, if you're a pilot at all, this little bit of pertinent advice is worth reading.

by MANLEY MILLS

SOME pilots, who have flown only heavy high-powered ships, are inclined to believe that the average lightplane is too dangerous, tricky, and under-powered to be of any practical value.

Incidentally, anyone who thinks a lightplane is under-powered, simply because it has a relatively small engine, is not taking everything into consideration. He doesn't realize that the small ship may have just as much horsepower in proportion to its weight as many large planes. The power *loading*, rather than the actual horsepower alone, is the important thing.

While a small plane with a very short span, intended only for racing or exhibition purposes, is usually difficult to handle, the amateur flyer is not interested in this type until he has gained plenty of experience.

On the other hand, a well-designed lightplane with plenty of wing area and properly proportioned control surfaces is just as stable and easily handled as any large machine, if not more so in some cases. It is true, however, that the lighter weight and shorter moment arms of a lightplane will give a different "feel" to the controls, which will be somewhat more sensitive, too, than those of a big plane.

It wouldn't be fair, though, to class these peculiarities as faults. They should simply be regarded as inherent characteristics of the lightplane. To consider them otherwise would be like expecting a light flivver to handle the same way as a big heavy bus.

There is a certain technique in handling these little ships which can be learned only from experience with the machine itself, regardless of how many hours you've had in a big plane. However, the pointers to be given in the following paragraphs may help you in this connection. Though intended primarily for lightplane pilots, or prospective pilots, they may be applied in a general way to the handling of larger and heavier machines.

First, we'll discuss take-offs. A take-off really consists of three stages: (1) The beginning of the ship's run on the ground, during which the slipstream against the tail surfaces is the only source of controllability. (2) Lifting the plane into flying position by raising the tail and holding it in the proper attitude until flying speed is reached. (3) Climbing.

When starting to take off, you should open the throttle slowly enough to require about three seconds to move it to the wide-open position. By doing so, you will give the ship a chance to start rolling gradually and gain enough momentum so that the thrust won't have a tendency to pull the nose over, especially if there are rough places in the field.

You should never jam the throttle open suddenly unless conditions make it an absolute necessity. There is always danger of choking the engine by doing this.

Flying a lightplane something like the one shown above is not the simple push-pull job some people are inclined to think it is. But the clean little job in the above photograph will perform beautifully for a capable pilot.

The second stage of the take-off is begun when there is sufficient speed, or slipstream velocity, to enable the pilot to lift the tail by pushing forward on the stick. At this point, you'll have to be on the alert, for the tail of the little ship will come up faster than you expect, and you'll have the nose on the ground before you realize it if you're not careful. I don't mean by this, though, that you have to jerk the stick back and forth with lightning speed. On the contrary, all movements should be made smoothly.

In connection with raising the tail, the ability of the inexperienced pilot to judge the attitude of the ship depends, to a considerable degree, upon his position relative to the center of gravity.

If he is seated some distance behind the center of gravity, as in most two-seaters, he can feel the tail rise better, since it will lift him through a larger vertical distance than if he were near the nose of the ship.

In flight, however, the nearer you are to the center of gravity, the better you can sense movements of the plane about any of its three axes. In this position, you feel that you are the center or hub of the plane, and in effect, become a part of the ship itself.

The start of the second stage of the take-off is a bad time for a bounce to occur. In the first place, a bounce at this point has a tendency to throw the nose into the air, and if the elevators are turned down very far, you may not have enough margin of control to bring the nose down again.

The result may be a series of bounces finally leading to a premature take-off. Another thing, a bounce at such a time is often accompanied by the dropping of a wing. In bringing the wing back up, don't forget the yawing effect of the ailerons at low speed.

Until considerable speed is attained, an aileron turned down will create more drag than it does lift, making the ship turn instead of bringing the wing up. Under such conditions, a wing can usually be brought up level by kicking the rudder in the opposite direction from the low wing, using the ailerons very little if at all.

After some speed is gathered, bounces are not serious, and the pilot is occupied mainly with holding a straight course by working the rudder. The turning effect of the slipstream against the rudder will be noticed, but another peculiarity, quite different from the slipstream effect, has been experienced with some lightplanes. During the second stage of the take-off, the ship may begin to swing badly from side to side.

And to make matters worse, the rudder seems to be incapable of checking this oscillation or yawing, apparently having lost its effectiveness, and feels as if it were swinging in dead air, almost.

This is partly due to the fact that the pilot, in an effort to stop the oscillation, is working the rudder just out of "time" with the swinging of the ship. But the underlying cause of the trouble has been traced to an insufficient fin area, and in some cases to a rudder with too much balanced surface.

In most cases, the fault can be cured by installing a larger fin. This fault seems to be restricted to small planes, since it is rarely experienced with a large machine.

The landing-gear of your ship should be no higher than necessary to provide sufficient clearance for the propeller and to give the wings the proper angle when the skid is resting on the ground. The higher the landing gear, the more difficult the ship is to control on the ground, and the harder the impact in case of a nose-over.

On the other hand, an undercarriage that is too low has its undesirable features. For one thing, the wings will not have a sufficient angle of attack when the tail skid is on the ground. This is of little importance in taking off, since the fuselage

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is practically level anyway. But in landing, the full braking effect of the wings could not be secured without landing on the skid first.

On a biplane with the landing gear too low, the "ground effect" or cushioning of air under the lower wing makes the ship seem noise-heavy when taking off. The wheels try to remain on the ground too long, and the ship has to be pulled off by moving the stick back. If it is balanced to feel normal while taking off, it will seem tail-heavy in the air.

The most common type of landing-gear used on lightplanes is provided with rubber cord for absorbing shocks. This does not give as soft an action as oleo shock absorbers, but that is really somewhat of an advantage in taking off, particularly to pilots who rely to a great extent upon the "ground feel" of the landing gear in judging when the plane has reached flying speed.

Right here, it should be pointed out that the safest way of getting off the ground is to let the ship fly itself off, then gaining more speed before starting to climb. Zooming off the ground may look spectacular, but so does a stall and spin.

The inexperienced pilot nearly always has a tendency to try to climb too steeply. This is often partly due to the fact that, as the plane gains speed after leaving the ground, his senses do not keep pace with the acceleration, and the ship may seem to be flying considerably faster than it really is. Consequently, he overestimates its climbing ability and pulls the stick back too far.

Then, since the little ship is so light on the controls in the first place, he may not feel an approaching sluggishness so readily. Here, an airspeed meter is of the greatest value, and you should install one in your ship if you have to swipe it.

This instrument, together with the feel of the controls, the angle of the nose with the horizon, and the increased pressure of the seat, will give you an indication of how the ship is climbing.

Here's another point you'll have to consider in getting the feel of your lightplane. While an experienced pilot can, by the use of instruments, handle a ship safely without even seeing the earth, in everyday flying the only means of judging the altitude of the plane is by a more or less subconscious view of the position of the nose and wings relative to the horizon.

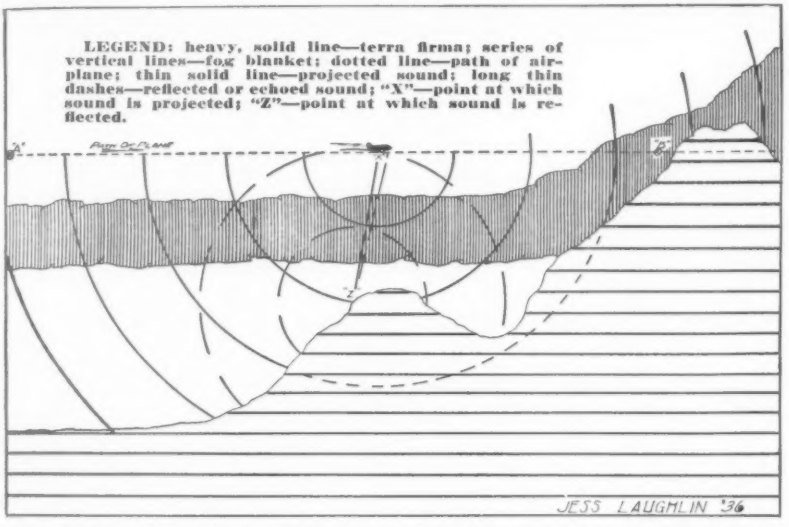
Now, in most training ships, the plane will be flying level when the top of the cowling is on the horizon. But the cowling of your lightplane may be in an entirely different position in relation to your eyes, or it may slope downward steeply toward the nose, as in jobs having an opposed motor.

In such a case, you may not feel at home for a while, until you get used to the new location of the cowling with reference to the horizon. It may seem that the ship is nosed down too much when in reality it is flying level, or even nosed up a bit.

One more thing should be considered in dealing with take-offs, and that is the problem of coping with unforeseen difficulties caused by uneven ground or adverse air

(*Continued on page 66*)

Sonic Altimeter Developed


LEGEND: heavy, solid line—terra firma; series of vertical lines—fog blanket; dotted line—path of airplane; thin solid line—projected sound; long thin dashes—reflected or echoed sound; "X"—point at which sound is projected; "Z"—point at which sound is reflected.
A
PATH OF PLANE
B
X
Z
JESS LAUGHLIN '36

A sound of 2,000 cycles is projected from the airplane at "X" in its path (A to B) and is projected into space. The projected sound wave hits a point or surface at "Z" and is echoed back. The time necessary for the return of the echo automatically is registered on the indicating sonic altimeter on the plane's instrument panel.

MR. L. P. DELSASSO, associate instructor in the physics department of the University of California, Los Angeles, has developed a sonic altitude meter, or altimeter, which will automatically give accurate readings in feet, or by the use of a dual ratio adjustment, can be changed so that it reads in hundreds of feet, on the same dial.

Delsasso's work has been made financially possible with the aid of the Guggenheim Fund for the Promotion of Aeronautics. The Bureau of Aeronautics of the Navy Department, the Army Air Corps, the Goodyear Company, and other commercial companies also lent invaluable assistance in its development.

With this machine accurate readings in altitude are possible regardless of varying air pressures.

When there is any decided change in atmospheric pressure, an altimeter (in effect a graduated aneroid barometer) may show highly incorrect readings.

An an example, let us suppose a privately-owned plane, flown by a pilot of little experience, takes off from a field with his altimeter set at the correct reading for the altitude of that particular field. If he does get into bad weather, which is always characterized by a low pressure area, then his altimeter will be affected.

With a sonic device as mentioned above this element of error would be eliminated, and as long as we are not concerned with flying speeds in excess of 750 miles per hour, it will continue to give accurate readings. Above that speed the sound waves which are used would never catch up with the speeding airplane or airship.

However, by that time it is reasonable to assume that progress in the development of the sonic altimeter will have kept pace with the development in airplane and airship speed.

Men with dirigible experience believe with certainty that dependence upon a barometric altimeter such as is now universally in use was responsible for the miscalculation that caused the crash of the dirigible Akron! There was a sonic altimeter in the tail of the ship, but it had to be located so far back in the tail, away from most of the engine noise, that it was most inaccessible.

Had reliance been placed in this instrument rather than upon the usual altimeter, probably a different story might be told.

I do not mean to minimize the worth of such fine instruments as are in constant use every day. By the use of present day radio in aircraft, pilots are constantly aware of weather conditions, and can make necessary corrections to counteract the effect of low pressure areas upon barometric altimeters with which they may be equipped.

The one obstacle which shall doubtless confront us for some time to come is fog, and in fog dependence upon the ordinary altimeter is somewhat hazardous. With a sonic altimeter this danger would be minimized, and furthermore one of its characteristics is that it becomes more efficient in heavy fog, or where the atmosphere has become moisture laden.

With its most urgent need at the time when it becomes most efficient, then we near that rare thing—a perfect instrument.

But no! Not yet. Delsasso is now concerned in putting his many theories into operation. In many instances his theories have already become well established facts. For example: he had mounted in the Goodyear airship Volunteer his sending and receiving device, together with the recording dial, and was able to accurately measure altitude from 4 feet to 700 feet above the earth's surface. So far experiments have not been conducted at greater distances.

(*Concluded on page 71*)

Notes On the Airplane Compass

by JOHN T. HAYWARD
Lieut. (j.g.) U. S. Navy

Interesting yet instructive notes on the construction and use of the airplane compass, its errors, adjustment and operation.

THE determination of direction is the most essential process in any kind of navigation. The aircraft compass is thus of supreme importance to the navigator of the air. It has been the subject of a careful and serious study but there is still a possibility of vast improvement.

The marine compass had been well developed prior to the advent of the aircraft compass and was adopted at first for aircraft use. Its first application to aerial use, however, showed that an entirely new development was needed before it would function correctly in aircraft. The severe conditions encountered in aircraft use altered the design radically.

A dry compass ordinarily used on ships was found unsuitable for aircraft use. This led to almost universal adoption of the liquid type of compass on aircraft. The liquid in the bowl serves a double purpose. It damps the motion of the card, reducing the oscillations and thus improving the stability. It decreases the apparent weight of the card, reducing the pivot friction and increasing the life of the pivot point by decreasing the intensity of the shocks given it.

In adapting the liquid compass to aerial use it was necessary to make a number of modifications, the most important being the adoption of a short period. The average marine compass has a period in the neighborhood of fifty seconds. An aerial compass with this length of period would take entirely too long to come to rest after a turn. Consequently compass periods of from ten to twenty seconds were adopted for aerial use. Other modifications included the use of stronger magnetic forces to overcome the sluggishness produced by the liquid and the attaching of the pivot to the card instead of to the bowl to reduce the turning effect due to vibration.

The common type of aircraft compass in use today consists of the following principal parts: (a) Rotating system, (b) Bowl, (c) Compensating device, (e) Support.

The rotating system is composed of the card, magnetic elements and bearing member. Two types of card are employed, the horizontal and vertical. Some instruments combine the two forms making both observations possible. The horizontal is generally employed throughout the U. S. Navy. This is due to the limitation of space and general instrument board arrangement. It is imagined that in the new big patrol planes the vertical will find favor.

The card is supported in the liquid by means of an ellipsoid float upon which the magnetic elements are mounted. Some instruments have a rotating system that is so light they require no float.

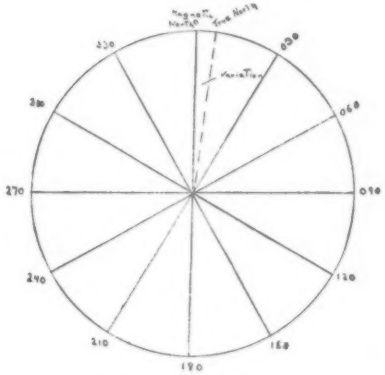
The magnetic elements are usually flat magnetized needles from two to twelve in number, of hard alloy steel possessing high retentivity.

The bearing member consists of a pivot attached to the movable element, resting in a cup or socket on a bearing post attached to the bowl. Agate is usually used for the pivot while sapphire is employed for the cup.

The bowl acts as a container for the damping medium. Its usual shape is cylindrical to reduce the swirling effect of the fluid on changes of heading.

The damping fluid used must have a constant viscosity over the usual range of operating temperatures. The liquid employed in the majority of aircraft compasses in the United States is acid free kerosene under the trade name of varnoline.

Owing to the presence of magnetic fields set up by the structure of the plane itself it is necessary to provide a compensating



The Compass Rose.

device to minimize the influence of these fields. These devices are too numerous to describe in detail.

Two of the kind employed in the Navy will be described. The device on the earlier compass consisted of a holder mounted on the bowl directly below the card, centered relative to the axis. The holder contained a fore and aft and an athwartships tube in which small correcting magnets are placed. The chief disadvantage of this was the difficulty of putting the small magnets in with the instrument board as crowded as it was. The amount of compensation was determined by the number and strength of the magnets used.

The latest type consists of a small square compartment mounted directly beneath the bowl. The box contains a set of magnets mounted on a helical screw with a ratchet attachment. Two screws thus control the fore and aft and athwartship motion of this magnetic field. By means of this field the compensation is accomplished as will be explained in detail later.

The support of the compass is important because of the ill effect vibration has on the compass. The support in general use now is to mount the bowl on rubber cushions so that the plane vibration is not transmitted to the compass. The points of attachment are placed in oversize holes with ample room for movement of the support without any movement of the compass.

The errors of the compass are very important and all pilots should be familiar with them and the necessary corrections in order to use the compass intelligently. The compass is subject to errors due to: (a) Calibration, (b) Pivot friction (c) Linear acceleration, (d) Turning of the plane, (e) Vibration, (f) Tilting of the card, (g) The magnetic disturbances set up by the plane structure.

The calibration and pivot friction errors should not exceed two degrees in a good compass. The keeping down of the weight of the card will reduce the pivot friction error to a minimum.

As the center of gravity of the needle does not lie in the vertical line through the point of support linear acceleration produces a moment about the point of support tending to deflect the needle. This causes an error depending on the linear acceleration.

The most difficult error to deal with is when the aircraft turns from a Northerly course. This error is called the "Northerly turning error." This is in reality a misnomer. This error is present in all quick turns but it is most noticeable when turning from a Northerly course.

The earth's magnetic field is not horizontal. The angle of dip varies from zero degrees at the magnetic equator to ninety degrees at the magnetic poles. A compass balances the vertical component of the earth's field by a small mass on one side of the point of support, thus the horizontal component is the only directive force acting on the compass. When a plane makes a quick turn the resultant effect of gravity and centrifugal force makes the plane of the card incline to the horizontal.

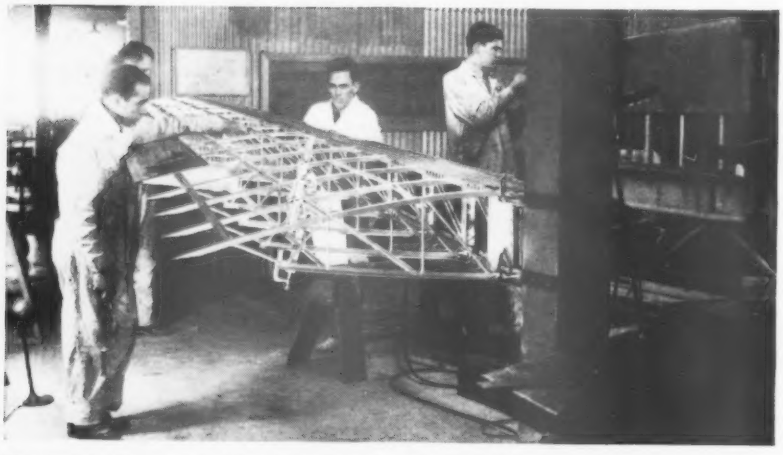
This inclination brings the vertical component of the earth's field into play and it exerts a directive force on the compass in the plane of the card. The direction the card will turn will be the direction of the resultant of the component of the vertical force and the horizontal component of the earth's field. This error thus depends on the angle of bank and the length of the turn.

When turning away from North, the North end of the card is drawn down and if the turn is rapid enough, may indicate that a turn has been made in the opposite direction from what is actually the case.

(Concluded on page 55)

XUM

Some Practical Advice On



The metal wing shown above is largely the job of expert riveters. The above photograph shows the details of that particular type of all-metal wing.

by ALLAN F. BONNALIE

Director of Technical Instruction,
Boeing School of Aeronautics

DURING the past several years there has been a rapid change in the type of construction for all classes of airplanes, the general trend being away from wood and fabric as construction materials toward all-metal planes.

In keeping with this changing design, it has become necessary to alter instruction of airplane mechanics to give them experience in the newer methods which are coming rapidly into play in factories and maintenance shops.

Sheet metal working, therefore, becomes an invaluable part of the mechanic's training. Due to the peculiar characteristics of certain aircraft materials and the necessary fabrication methods, special training and experience are necessary, since previous experience with steel, copper and other common industrial metals cannot be applied directly to aircraft construction.

To this end, the Boeing School of Aeronautics has developed a practical plan of instruction which has been simplified into two phases: classroom lectures and separate "projects," wherein the student first learns the peculiarities and unique properties of aircraft materials and methods and, second, actually works with them in the metal shops.

Students first learn the changing language of aircraft metals. For instance, "Dural" is the popular term applied to material ordinarily known as duralumin, which originally was a development for use in construction of Zeppelin airships. Strictly speaking, modern airplane construction uses not only the material which can be strictly called duralumin, but also many other alloys having various characteristics.

These alloys are generally grouped together under the term of strong aluminum alloys, which are designated by number to designate the alloy, followed by the letter "S" to indicate it is of the wrought group, and then a letter or pair of letters to indicate the condition of the alloy, "O" indicating dead soft or normalized, "T" indicating heat treated and age hardened, "R" indicating work hardened. Other letters designate different grades of treatment. The more common alloys are 17S and 24S, the former having been in use several years, the latter having become popular recently.

The 17ST alloy is the material most commonly called duralumin. It is used where strength is required, whereas 53S may be employed where strength is not of importance but where welding is necessary, such as in gasoline tanks and chairs. The mechanic must learn, too, that duralumin possesses certain metallurgical characteristics which are worth noting: hammering, bending and forming into structural shapes harden the material rapidly; but after a certain strain hardening the ductility decreases to the extent that further working may crack the material.

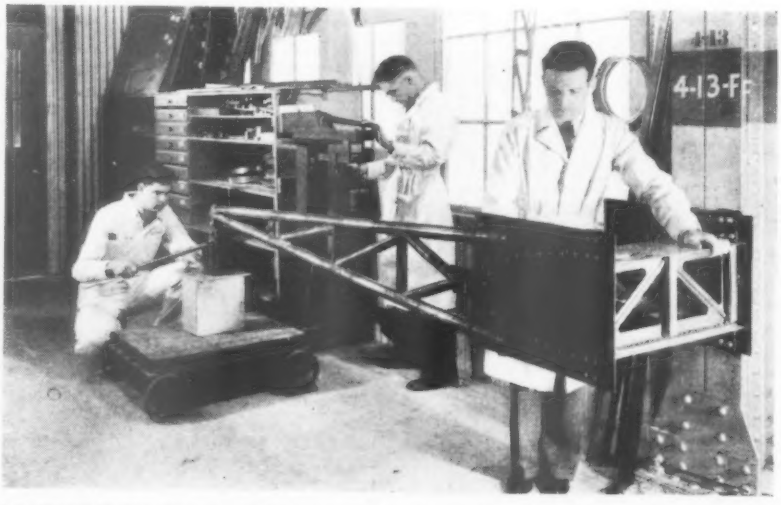
After severe cold working, the metal must be annealed so that the original hardness and ductility are restored. This is known as removing the temper. Annealing is accomplished by raising the work-hardened material to 650 degrees F and allowing it to cool slowly. After heating and quenching the material, it must age four days before it attains the desired condition of hardness. Heat treating doubles the ultimate tensile strength.

Now, suppose you were to be assigned a job requiring you to rivet a job, undertake what we know as "assembly fitting" or try your hand at "severe working" these materials in bending. How would you proceed?

Insofar as space permits, I shall explain the steps to be followed, following the pattern of "project instruction" as developed at the Boeing School of Aeronautics. Each project is simple, is taken up in stages and follows a definite plan which, with practice, produces a skilled workman.

1—Riveting practice. We start with a single strip of metal 3 in. wide x 8 in. long. We consult the blue print attached for instructions. It calls for the edge to be broken down before riveting, with 17ST rivets to be driven in two rows every ¾-in. horizontally and ½-in. latitudinally.

First, you analyze the blue print. What



Engineers in the above illustration are about to conduct a static test on an all-metal section of the leading edge of an airplane wing. These tests are designed to reveal the quality of the riveting.

Metal Working for Aircraft

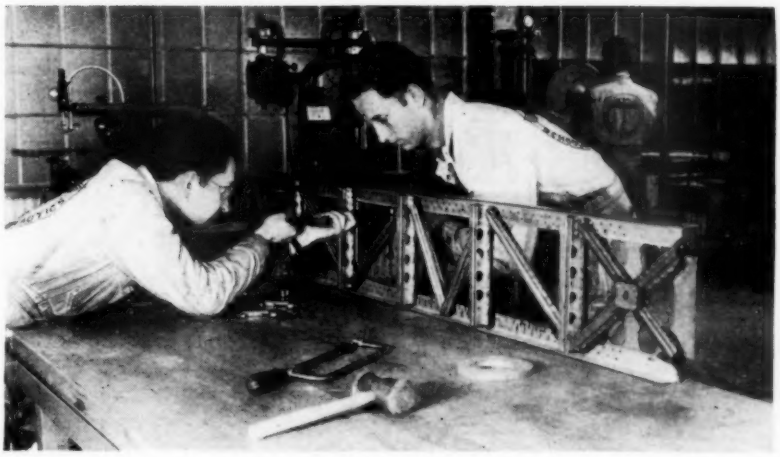
kind of joint is called for and why are the edges bent? The project calls for a double-riveted lap joint, using brazier head rivets, and the sheets are slightly flanged to give greater joint stiffness and tightness. Having obtained the kind of material called for, of the proper gauge, and the rivets, you next square the material to size.

Cut the long side first, using squaring shears, then square the adjacent side with the squaring head. Allowing sufficient material for filing to size, now measure with a metal scale and lay out cut-off lines on the material with a pencil—never use a scribe on dural.

Having squared the piece, check it for dimensions. This must be accurately done. If one side and the two adjacent ends are square and true, the fourth is likewise accurate and becomes the lap joint. Next, file to exact size, after which you lay out the rivet centers. Rivet spacing is generally determined by the thickness of the material used, size of rivet and the type of loading the joint must withstand. In nearly every case, certain standard spacings are recognized.

Now you are ready to center-punch. A center punch is used to definitely mark the center of the hole that is to be drilled. However, center punch marks, scribe lines and any other method of marking material that cannot be removed are to be avoided, due to the fact that most aircraft materials are subject to corrosion which attacks scratch marks immediately. Furthermore, scratches often result in cracks from fatigue failure of the metal. Therefore, punches of the normal type are only used to mark material that will be removed immediately.

Now the edges may be braked, due to the necessity for strengthening the sheet at a joint, and the work assembled and clamped. The most popular type of clamp used in aircraft work is the so-called "C" clamp. Make sure in using this type that its feet are covered with a soft material in order that the assembly may be protected against scratches. Clamps should be tightened tightly by hand to avoid "creeping" in the subsequent work.



Here students of the Boeing School of Aeronautics are shown riveting a spar into an all-metal wing.

In drilling the holes, you may use either an electrically- or a hand-driven drill, the latter being used in aircraft work for delicate operations and cutting out bad rivets. The drill size will depend upon the size rivet to be used.

When the holes are drilled, you are ready to commence tack riveting, by which term we mean the placing of a few rivets widely spaced to further clamp the assembly for final riveting.

In proceeding, you may use any of three methods: hand riveting with hammer and set against the bench stake or helpers' dolly bar, machine riveting with an air hammer (rivet gun) against bench stake or helpers' dolly bar, or squeeze riveting with a squeeze-riveting or "bull" machine.

You will find, after inspecting the assembly to this point and correcting any misalignment which may have crept in, that ordinary tack riveting will hold the joint sufficiently rigid that rivets may be placed continuously.

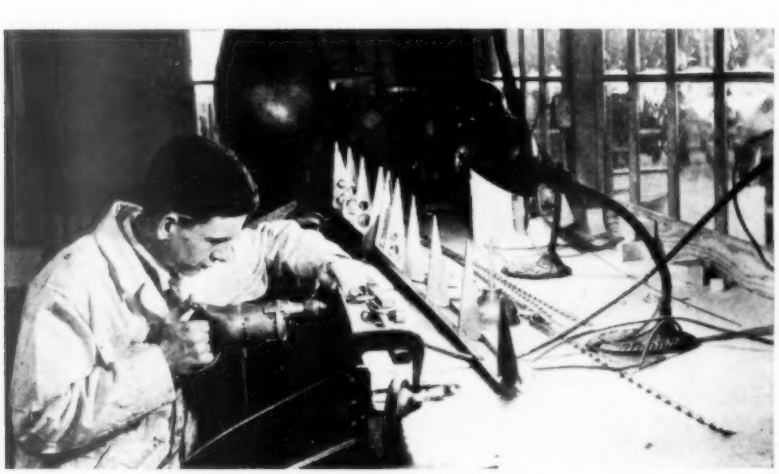
For careful work, however, tack riveting should be continued until the job is complete. Finally, since this job is intended to develop accuracy in riveting and aligning, inspect the job carefully and wipe it off clean before deciding whether you have done a satisfactory job.

2—Now for assembly fitting, the second project. This consists in producing a special lap-joint forming a tri-square. The main object of this undertaking is to attain an accurately fitting, right angle joint. Special care must be taken to prevent inaccuracy from the final riveting.

Again, you analyze your job and inspect the blueprints. Obtain the material of the kind and thickness called for, as well as the proper rivets. Material in this case is duralumin 17ST, the number referring to the alloy type and the ST means it is a wrought aluminum alloy in the heat-treated and aged condition. The gage number is seldom used in aircraft work because of the difference in the metal gage types. The proper way to refer to this material, therefore, is as 17ST, 0.0508 in. in thickness.

You will note from the blueprint that each strip is one in. wide and that there are three parts to the assembly. The material can be obtained easily from a single strip slightly over one in. wide and enough over eight in. long to allow for shearing and filing operations. Cut one long side first, square up one end using the squaring shear. Lay out in pencil the length necessary for each part, making certain again to allow enough material for filing.

Next, check your dimensions, because all parts must fit accurately in the final assem-



This Boeing pupil is drilling the holes preparatory to building up the jig by riveting for the assembly of the aileron.

bly. Be certain, however, that all parts are slightly oversize to permit filing. In filing to exact size and fit it is better, in order to attain complete accuracy, to clamp assemble the three parts and check the angle between the two legs with a square.

Filing, therefore, must be accomplished to insure very accurate fitting. Very likely you will find it necessary to assemble and disassemble several times before the desired fit of all parts is achieved.

Now lay out the rivet centers. Since this assembly is quite small, it is best to disassemble and isolate the 1 x 3 member that contains eight holes. Carefully lay out the eight holes in this member alone with the idea in mind of drilling the other holes in the other members after assembling.

In center-punching, remember that it is never necessary to center punch a material severely. The only purpose of such a mark is to enable the drilling operation to start accurately. If the hammer blow is too severe, you likely will find the material itself has been "work-edged."

Drill the eight holes in the piece marked. Now assemble and clamp. Because of the smallness of the assembly, provision must be made for holding it accurately, at the same time working rapidly. A "C" clamp, therefore, is used to hold the 1 x 3 members together until two holes can be drilled.

Parker Kalon hardened self-tap screws are forced into the holes with the use of a screwdriver. This is a new and efficient method of temporary clamping which allows the "C" clamp to be removed immediately. The small 1 x 2 piece is next C-clamped until two more holes can be drilled and the part "P.K'd" to the assembly.

Following this, the holes are drilled in the assembly, making it ready for riveting. Again, proceed to tack. In this sample, there is little doubt where to place the rivets, because only two holes are left in each piece. Rivets are placed in the assembly to hold more securely than would be the case with Parker Kalons.

After filling all holes, substitute rivets for the Parker Kalons. It is well to remember that Parker Kalons are put in from one side only, making them superior to a bolted assembly for "hidden work."

If care has been exercised, a check for alignment will show everything is under control. Any misalignment can be checked easily as you go along with a protractor square. At this time riveting may be completed by removing the Parker Kalon screws and riveting through the same holes, an easy task because alignment already has been checked. In less accurate work some creeping would take place, which would require reaming with the regular drill. Inspection should reveal a nice job.

3—Severe working. Here, making allowances for the severe stretching that takes place in either a folding brake or over a bend block, you learn to bend hard materials accurately. Special care must be taken in a temporary clamp setup to see that accuracy is retained.

The material is again 17ST duralumin 0.0508 in. thick, with 1/8-in. 2SO rivets (dead soft), with brazier heads to be

(*Continued on page 60*)

. . . and Now We Have the "75" Pursuit

THE accompanying plan is for the latest of Curtiss pursuit aircraft, the almost mythical "75."

Formerly designated the X-17 Y, and then 75, this new ship is undergoing vigorous tests by the Army Air Corps. When first it made its appearance, the "75" was powered with a twin-row P&W Wasp, of much smaller diameter than the engine now employed, the Wright Cyclone SGR 1850 G5 single-row 750 h.p.

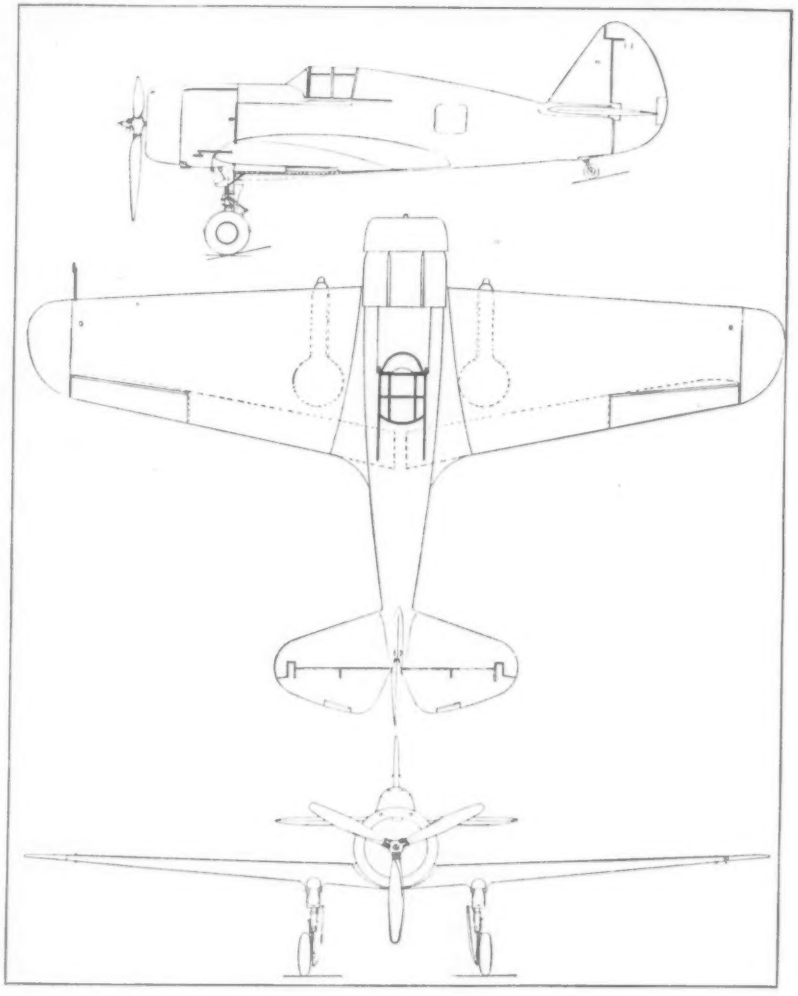
With the former engine the plane had an actual test speed over Buffalo Airport of 268 m.p.h., but since the latter engine's installation, the speed has been bettered to approximately 304 m.p.h.

Some considerable refinements have been adopted during the last six months, not the least of which is the better fairing and operation of the landing gear, which as you will notice is a single-strut type operated by a radius gear, which is responsible for flattening the wheels against the windstream and retracting each leg laterally in unison.

Tail-wheel also retracts rearward and upward. All parts of the 75 are of metal and stress skin with minor exception to the rudder and elevators. Plane is equipped with flaps. Twin Browning guns fire forward, location of bomb racks is underneath wing on either side of landing gear wells. Propeller is flight adjustable Standard.

To date three of these ships have been ordered by the Army Air Corps for, it is believed, experimental purposes.

Even America is keeping up with the rest of the world by buying the latest in military aircraft. Above is a view of the trim nose of Curtiss' latest in high speed pursuit aircraft—the "75" or, as it was originally known, the X-17Y.



Conquest of the Stratosphere

by CHARLES G. PHILP

The author, an English scientist, has paid particular attention to stratospheric navigation and is well versed in rocket technology. He is the author of a well known book on rockets and rocketery.

THE outstanding feature of the social life of the World today, compared with that of a quarter century ago, is the extent to which space and time have been annihilated—not only in a mental sense, as by radio and television, but in a physical sense as well, by the acquisition of high speed passenger transit.

We are today, not so much living in an age of *actual* speed—as many people think—as we are living in an age of *suggested* speed.

It is true, that the brief space of twenty-five years has covered the country with motor cars, and that local and parochial distances have shrunk to negligible limits. But so far as speed itself, in a world sense, is concerned, we have barely even started!

There is a fairly widespread impression today that speed is, in itself, a dangerous thing.

Few people realize that, almost as if by some special dispensation of Providence, Nature has specially equipped mankind for the purpose, inasmuch as it is a definite physiological fact he is not gifted with any sense organ which will convey to his consciousness the sensation of CONSTANT SPEED.

This is obvious when we pause to consider that we are all, each and every one of us, travelling at a *constant* speed of approximately 65,000 miles an hour around the sun, without feeling conscious of the fact. And there is also another trifling matter of 1,000 miles an hour, due to the earth's diurnal motion, which, too, we fail to be conscious of.

As a matter of actual fact, it is only the acceleration at the start, and the deceleration at the end of a high speed flight that are of grave importance. Unless both of these are kept within certain well defined limits, high speed flyers would be crushed to death by the inertia of their own mass.

Parachutists have demonstrated by "free falls" in space that the human frame can safely stand an acceleration of 32 feet per second. This is, of course, far too great to be comfortable—at least for public service purposes—but it affords us some idea of the maximum rate of acceleration that can be borne without fatal consequences.

Nevertheless, despite this physical endurance limit to the rate of acceleration, it is not a factor of any great importance preventing the acquisition of ultra-high speed.

For example, it has been calculated, that the rate of acceleration of a fast racing car—in which it is desired to attain a maximum of speed in a minimum of time—is such, that if it were possible to maintain it for only ten minutes, a speed of 2,000 miles an hour would be reached.

So long as the speedometer needle is moving upwards, we experience considerable physical discomfort—feelings that can be compared to those at the start of a journey in an express passenger lift—but once a CONSTANT speed is attained (say 80 miles an hour) and the needle is stationary, or moves within very narrow limits, we feel no sense of motion whatever, and all physical discomfort vanishes.

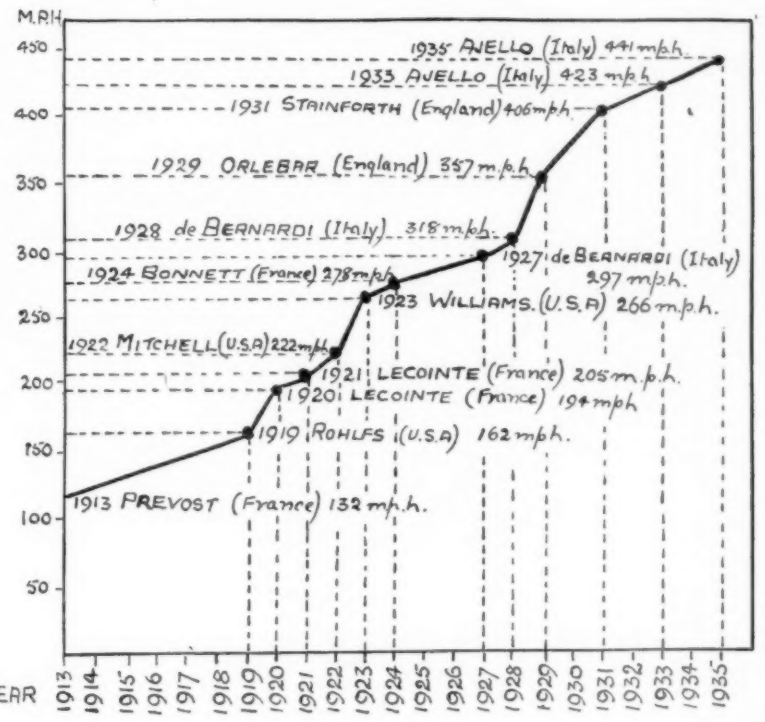
Of course, in this simple illustration, the effects due to wind pressure and visual effects such as dizziness, have been ignored, because in a closed in cabin, they would not exist. The whole point at issue is the human sensory system in its relation to CONSTANT speed, not its relation to external effects which can be eliminated.

Hence, whether the speed we wish to attain is 1,000 miles an hour or 10,000 miles an hour, we shall be limited in the future by the question of power and the mechanical means at our disposal: *not by any physical limitation on the part of the human sensory sytem.*

Incidentally, it is this fact that constitutes one of the basic principles of rocket flight.

We see, then, that speed in itself, is NOT dangerous, and that given ways and means of acquiring greater speeds than any hitherto attained, there need be, practically, *no limit* to the speed the human race may one day achieve!

Now let us review the constant and progressive gains in speed made during the past 23 years. The best way to illustrate this is to take the World's speed records in airplane flight, and plot them in the form of a graph. The result is shown below:


M.P.H.
450
400
350
300
250
200
150
100
50
1935 ANELLO (Italy) 441 m.p.h.
1933 ANELLO (Italy) 423 m.p.h.
1931 STAINFORTH (England) 406 m.p.h.
1929 ORLEBAR (England) 357 m.p.h.
1928 de BERNARDI (Italy) 318 m.p.h.
1927 de BERNARDI (Italy) 297 m.p.h.
1924 BONNETT (France) 278 m.p.h.
1923 WILLIAMS (U.S.A) 266 m.p.h.
1922 MITCHELL (U.S.A) 222 m.p.h.
1921 LECOINTE (France) 205 m.p.h.
1920 LECOINTE (France) 194 m.p.h.
1919 ROHLFS (U.S.A) 162 m.p.h.
1913 PREVOST (France) 132 m.p.h.
YEAR
1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935

It will be seen that the steepness of the curve has been maintained throughout the whole period, 1913-35, and there is no indication that the gains made in the past will not be maintained in the future.

Associating this fact with the state of invention and discovery in all matter affecting aviation development, we find that the outlook for the future never seemed more promising.

Great though the past discoveries in metallurgy have been, even greater ones are promised in the near future, when alloys of magnesium and berrylium will make possible the construction of stronger airplanes for appreciably less weight.

Lighter and more powerful engines are also constantly being produced. And not only are fuels being produced which will give more power in a given engine, but engines are being perfected which will give more power from given fuels.

In short, in every aspect of future construction and design, there is no reason to suppose that airplane speeds will not continue to increase in the future as rapidly as they have in the past.

But an analysis of the dynamic condi-

tions affecting high speed airplane flight tells quite a different story.

For it is clearly evident that airplane speeds are now being approached where the old "velocity squared" law of resistance no longer holds good, and that the air resistance offered to an airplane in flight will henceforth increase at a prodigious rate.

It has been calculated, for example, that when airplane speeds reach 660 miles an hour (they have already reached 441 miles an hour), the air resistance will have grown to the *fifth* power, instead of as the square, for much lower rates, and any further increases in speed beyond this limit would entail such an appalling waste of power, as to be prohibitive.

Even the increase from 660 to 670 m.p.h. —a mere 10 miles—would, it is believed, entail an additional 100 h.p.!

There is also another factor. If we consider the tractive effect of a propeller in its relation to power, it is a well known fact that when propeller speed exceeds a certain limit, it manufactures sound, but gives no additional pull. And any increase in propeller pitch, or diameter, to maintain efficiency, is obviously limited.

In addition to these limitations there is also another factor of unknown dimensions, involving entirely new problems in aerodynamics.

Science believes that all gaseous substances, such as air, consist of molecules which are in a constant state of motion, and the molecules move in all directions. At a speed of 660 miles an hour, the speed of the airplane approximates to the speed of these molecules and, in consequence, instead of flowing smoothly round the wings and giving lift, they would fly off in all directions, bringing about various complex results with diminution of lift.

Summing up, we can only conclude that despite the very great gains in speed made in the past 23 years, and notwithstanding the promising outlook of the future from invention and discovery, further gains in speed beyond 660 miles an hour would appear to be physically impossible.

For some little time after this conclusion became obvious to scientists, no possible means of overcoming this physical limitation in speed could be suggested. But the stratosphere balloon ascents of Professor Piccard, and others, from 1931 onwards, and his confident predictions the stratosphere would become the world's highway for high speed, long distance, airplane flights of the future, at once suggested a means of overcoming the difficulty, and stirred airplane designers to fresh efforts.

As is now fairly well known, the stratosphere is the region beginning at a height of approximately 10½ miles at the equator, sloping down to 5½ miles at the poles, and extending upwards to a height, above sea level, of perhaps 30 miles.

Within this region, not only are gales, fog, snow, ice and all other climatic changes which adversely affect aerial flights at present day levels, non-existent, but the air is so thin (nine-tenths of the whole air content of the globe being at lower levels) that resistance to flight is enormously reduced.

For this latter reason, and, *provided a means could be found of converting engine*

(Concluded on page 52)

National Aviation Show Creates Great Interest

ALL of the aviation attainments, accomplished and impending, with which readers of POPULAR AVIATION have been kept abreast through its columns, will be on display "in person" on four floors of Grand Central Palace, New York City, from January 28th to February 6th, 1937, inclusive, at the National Aviation Show, in fulfillment of plans now progressing, according to G. A. Parsons, Managing Director.

The National Aviation Show is being conducted under the auspices of Aviators' Post No. 743, The American Legion, with the sanction and support of the Aeronautical Chamber of Commerce of America, and the cooperation of various other national aeronautic organizations.

Among the exhibits which it is promised will be on display are some of the "foolproof" planes developed under the patronage of the Bureau of Air Commerce of the United States Department of Commerce, the new roadable autogiro, and one or more of the new low-priced private planes now being built around inverted automobile engines.

All of these late developments catering to the pilot and prospective pilot of limited pocketbook will be in addition to a complete collection of private aircraft, ranging from the powered glider to high speed cabin ships, serving both for sport and business use. Particular attention will be paid to planes of unusual safety and stability features and increasing speeds from modest power-plants.

The growing popularity of pontoon jobs interchangeable with wheels, sport seaplanes and amphibians will present a rounded picture of that phase of flying, embodying marine terminals and waterfront hangar facilities.

A. F. Hartney, a National Aviation Show official who will be prominent in its affairs.

G. A. Parsons, Managing Director of the forthcoming National Aviation Show.

Schools will present the latest methods of instruction, both theoretical and practical, supplementary to courses now being given in many public schools. Some schools specializing in ground courses report that they are unable to meet the demand for graduates in employment offers from airplane factories, the facilities of which are being taxed by new orders for aircraft for civil use.

Other schools represented will acquaint visitors with all details of flying courses aimed to qualify students for every type of pilot's certificates granted by the government, and various plans to establish and cultivate Flying Clubs.

These features are educational to the highest degree, both for the young man intending to take a course in aviation or to the intending owner of an airplane. In former shows, the school exhibits always received the lion's share of popular attention.

Such exhibits will share equally with the complete story of modern air transport and general navigational aids, ranging from the robot pilot to the latest blind-flying instruments and radio traffic control. Airport and airway equipment, military and naval ships, and the thousand and one accessories from fashionable flying togs to gadgets aimed to make flying safer, more convenient and more comfortable, will tell their story in scores of fascinating displays. Air-minded boys and girls will find a comprehensive exhibition of model-building equipment with particular attention to model power plants and complete prize-winning models of every type.

In addition to such a fine panorama of contemporary progress in aviation, other exhibits will tell the story of the growth of the flying art from its infancy.

Constant Speed Propellers

OF increasing importance today is the use of the constant speed propeller which, holding the engine to its most efficient speed, reacts to power changes, climbs, or glides, by varying its pitch.

Available heretofore only on the highest powered Cyclones, where the governor mechanism is mounted on a specially designed nose section, the Hamilton Standard constant speed propeller has now been applied to the Whirlwind by the designing of a new accessory drive for the rear of the engine. It can be used on all seven and nine-cylinder Whirlwind models regularly equipped with the two-position, hydro-control mechanism.

The new accessory drive, attached below the right magneto at the fuel pump drive location, is a three outlet box using beveled gears. It affords a drive for the constant speed propeller governor, a fuel pump, and a vacuum pump. However, the driving gears for either the fuel pump or the constant speed governor or both may be omitted if those accessories are not desired. It can be installed on seven-cylinder Whirlwinds already in service by means of the usual mounting studs. The nine-cylinder Whirlwind engines will require the addition of one stud for which provision has been made.

The constant speed propeller governor consists of an oil pressure pump and a centrifugally governed device for regulating oil flow. It is mounted on the drive by means of an adapter. Two oil lines are fitted to this adapter: one from the engine oil supply to the adapter, the other from the adapter to the nose section, where it enters a special fitting which replaces the hydro-control lever.

Oil is taken from the engine to the governor pump, from which it is delivered to the propeller mechanism under approximately 200 lbs. pressure. There its function is to turn the blades into low pitch. The flow of this oil, however, is controlled by the other unit of the governor, the centrifugally operated valve. By means of a special adaptation of the familiar centrifugal governor principle, this valve directs the oil to the propeller mechanism only when the engine slows down below the r.p.m. for which the governor is set. The propeller then goes into lower pitch and the engine can return to its proper speed.

If the engine speed is correct, the valve remains completely closed, cutting off all oil flow to or from the propeller mechanism. If, however, the engine speed increases, the valve moves in the other direction, allowing oil to return from the propeller, and permitting the centrifugally actuated weights on the propeller blades to turn the blades into higher pitch, thus slowing down the engine to the proper speed. The governor can be regulated from the cockpit for any desired r.p.m.

To both the private flyer and the airline operator the constant speed propeller presents numerous advantages. Take-off distance is lessened, since the engine can turn up its best speed at the start as well as the finish of the run.

Three Interesting Foreign Airplanes

The New French Latecore "300" Flying-Boat.

The Japanese Nakajika P.1.b. mailplane.

The new Caudron "Typhoon" type of transatlantic plane.

ABOVE are three planes of unusual interest because of their departure from conventional airplane design.

First, is the four-motored French flying boat, the Latecore "300," with the two motors located on the top of the high monoplane wing. It is provided with four Renault engines placed fore-and-aft.

The Nakajika P.1.b. is a Japanese mailplane that has more of the appearance of a pursuit job than a plane for scheduled airline operation.

Last is the "Louis Bleriot," a new type of French Caudron plane known as the typhoon. It is intended for a transatlantic hop to be made by Rossi.

A Swedish Trainer Designed Along Novel Lines

This Swedish pursuit training fighter has unusual lines and plentiful gaiters.

UP in the land of the Midnight Sun, a little firm known as Sparmanns have been producing aircraft for some time, and one of the newest of the planes is a low wing monoplane, used as an advanced trainer by the Swedish Air Force.

The S-1 is designated as a "training fighter," for with certain variations of equipment it may be used to train pilots in pursuit, bombardment, and dive bombing duties.

The ship is of composite construction and is powered by a De Haviland Gipsy Major motor, developing 130 horsepower. It is economical in fuel consumption, but despite its low power it has a top speed of 160 miles per hour and is able to cruise at 130 miles per hour.

It has a span of 26'-3" and an overall length of 20'-3½". The fuel capacity is thirty gallons and, with capacity tanks, the ship has a cruising range of 500 miles per hour at cruising speed. The empty weight of the S-1 is 905 pounds and its useful load is 385 pounds, making a gross weight of 1,290 pounds. It has a wing area of 90.5 square feet.

The forward section of the fuselage is covered with sheet metal, while the rear section is covered with linen fabric. The wings are of wooden construction with two spars, covered with diagonal plywood planking and externally braced to the fuselage and landing empenage, with streamlined wires.

The ailerons which are statically and dynamically balanced, mounted on ball bearings, are also of wooden construction, with the rear part fabric covered.

The Sparmann S-1 has been accepted by the service pilots of the Swedish Air Force with great satisfaction and it is even accepted by the private owner in Sweden as the up and coming plane.

Here's a Muscle Powered Plane!

AN airplane with its propeller driven by muscle power has been successfully flown at Redstock airdrome. The pilot, named Duennbell, flew a highwing machine, fitted with treadles, which turned the propeller, a distance of 600 feet and 725 feet in two attempts, the plane maintaining an average altitude of three feet.

The pilot was competing for a prize of $2,000 offered by the Frankfurt Polytechnic society for the first human muscular power flight of 1,500 feet and around two pylons.

Synthetic Rubber Balloon

IN current service tests the army's first observation balloon made entirely of synthetic rubber and fabric is proving more satisfactory than balloons of genuine rubber. Extensive tests on substitutes were conducted at Wright Field, Dayton, prior to construction.

Since rubber is available only by import, development of a practical substitute is regarded as specially desirable in the military field, because of possible blockade or other embargo.

Wright Field engineers found the substitute compound superior to rubber for lighter-than-air construction in laboratory tests and exposure on weather racks for an eight-month period. Tensile strength at the end of that time actually was greater than at the outset, they discovered. Leakage, amounting in the rubberized product to 15 to 19 liters per square foot per hour, is reduced in the new fabric to one to three liters.

This is the synthetic rubber observation balloon.

Arkansas Children Say It with Trees

by R. A. COOPER

"SAY It with Trees" is literally what the Lexa, Arkansas, school children are doing with their school grounds, and they are making the slogan work two purposes as well.

They are planting their trees in such a way as to have shade so that in future years pilots will be able to get their bearings from their school grounds. The trees spell out the word LEXA in a 50 by 200 yard sign.

The crash of the Southerner near Goodwin, Arkansas, with the death of seventeen persons made the people of this region air-minded as few other things could do. A regular scheduled air route runs a few miles north of Lexa and planes sometimes get off their bearings.

Several times last winter planes flew over the town at a very low altitude, apparently trying to locate themselves. Hence the school boys and girls, after discussing it, decided that they could help by planting a tree sign so pilots might get their bearings when flying low.

First, the question came up as to what trees to plant, how to plant them and how to care for them after they were planted. It was finally decided that sycamores should be planted, since they make a nice round-topped tree when by themselves and they grow well in this section. Then it was decided to spell their town name and care

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Last Days of the Gates Circus

by JOSEPH R. JAMES

In this last article, of a series of articles, the author tells of the sad adventures and mishaps of the Gates pilots after the circus came to an end. It rather points to the fact that the old crates were safer than many of the modern types that succeeded the Standards and Jennies.

WHEN the Gates Flying Circus folded up its wings and came down to earth, many of its eagles took off to seek fresher horizons.

Some found fame and others took their last flight, but those who watched the Circus sweep across the continent in the "Rushing Twenties" will never forget the courage and genius of the men who will never fly again.

Perhaps it was significant of fate to wait until after the Circus disbanded before tragedy visited these flyers singly. One after another cracked up and, today, there are only a few of us left, waiting for our turn.

The first one to go was Major Lee Mason of Nicaraguan fame. Shortly after the circus folded up, Mason, Ives McKinney, Warren Smith and Bill Brooks moved to Perth Amboy. The Major and Smitty organized a small school of their own while McKinney connected with a young hopeful who was building an open three-place top wing monoplane using a Hisso-Wright for power.

While this ship was being built, Mason put himself and a passenger in the front cockpit of an OX-Travel Air and a student in the rear cockpit. The controls were hooked up in both cockpits but, due to the passenger sitting next to him, I doubt very much whether Lee Mason had effective use of his controls under these circumstances.

However, the three proceeded to stunt wildly over Hadley Airport in New Jersey at an altitude of not over one thousand feet. Eyewitnesses reported that, while attempting a slow roll, the ship never did right itself, diving into the ground upside down with its full power on. They heard the last, desperate shrieking of human voices above the roar of the motor while Lee, not for a moment giving up, struggled fiercely to take the ship away from the panicky student who had evidently "frozen" to the controls.

With a wide open motor and flying wires screaming, the ship crashed not far from the field, killing its three occupants instantly. Notified at Albany to attend the funeral, I climbed into my Travel Air sadly and took to the air to pay my last respects to one of the most brilliant flyers this country has known.

"Wild" Bill Stultz was the next victim on the long list. I first met Bill when I was engaged as an instructor for the Arrow Airways at Paterson, New Jersey. Bill was then chief pilot of the outfit, having resigned from the Circus some six months previously. At that time, in the spring of 1928, long distance trans-Atlantic flights were popular and numerous.

It wasn't long before Bill was approached by Charles Levine, New York millionaire junk dealer, to fly him across the big pond in the Bellanca NC-140, christened "Columbia" and later made famous by Chamberlain. But in the light of past developments, Bill confided to me that he might be crazy, but he wasn't that cracked, and so refused to make the hop for the publicity seeker. Levine was not the only one who approached Wild Bill for his services on trans-Atlantic flights.

Wistfully, old Jenny peers out at modern air-circus performers, perhaps with a grunt of disdain.

Mrs. Laura Grayson managed to engage him to fly her J5-Sikorsky amphibian from New York to London. One morning, with much fan-fare Bill took off with the owner and mechanic as passengers and flew out some 800 miles over the ocean. Seeing his gas could not possibly hold out to get him across safely, Bill turned around without saying a word to the ambitious lady bird and there never was a more surprised person than Mrs. Grayson when the following morning she sighted the familiar New York sky line instead of London Tower.

Bill gave up this job as a bad one for some excellent reasons, but this would not deter the reckless Mrs. Grayson. She named her ship the "Gray Dawn" and took off again the following week with a Swedish pilot at the controls. It never reached Newfoundland and never saw another gray dawn.

Amelia Earheart was the next one to team up with Bill Stultz. No one needs to have that flight retold, as it started the clever young lady on her rise to fame. Young, sensible, and with an honest desire to learn how to be a real flyer, she let Bill handle the controls completely and not once did she attempt to force her own suggestions on the veteran pilot. The result was a flaming success, landing in Wales in their pontoon equipped Fokker F-10.

Miss Earheart climbed steadily after this flight and today is the finest woman pilot in the world. As for Bill, unfortunately, he was not destined to enjoy his fame very long. He was retained as a personal pilot by young Reynolds (of tobacco fame) at a $12,000 a year salary and presented with a shining new taperwing Waco.

One day he took up two of his friends and, while demonstrating slow rolls, spun in on the old Roosevelt field. And this time, Wild Bill didn't walk away from the crack-up.

The third chap on the unhappy landing list was Ives McKinney. And sadly enough, just as in the case of Bill, it had to happen when the future was brightening up for Ives and everything looked rosy. The monoplane he helped build, at such great sacrifice of time, labor and expense, was finally tested successfully. Much was expected of it at the All-American Air Races held that year at Miami, Florida.

On his way down, heavily loaded and taking off out of a muddy field at Richmond, Virginia, Mack nosed it over and he never did have the heart to rebuild it again. He then took over the Standard Flying Service at the old Gates' home port, Teterboro Field in New Jersey, and just to liven things up and get some publicity for his new venture, Mack decided to stage an air meet with air races, parachute jumps and the whole works that goes to make an insatiable public shriek with delight.

In one of the racing events, Mack was flying an OX5 Lincoln Trainer. While rounding the home pylon in a tight vertical turn, just scraping the ground and hot on the tail of the leading ship, the pilot hit the prop wash and was thrown on his back.

He almost righted it, but in attempting to do this, he lost the few feet he had above the ground, dug his wing tips into it and made three complete cartwheels before coming to a stop, a sad, mangled mass of steel tubing, torn and shattered fabric all wrapped up around crushed, bleeding and dying Mack. He lived only a few minutes and died with a careless grin on his face before they could free him from the twisted wreckage.

Just a month later, the mysteriously lucky Roy Ahearn appeared at Teterboro

XUM

and was immediately fascinated by a small wooden top wing monoplane of Belgian make, popularly known as the Albert Sport. Roy had been managing a one ship, one pilot flying circus, known as the Red Wing Flying Service, for over a year, barnstorming all over New England with considerable success.

But this new little ship was too intriguing for Roy's curiosity and he took it up, flew around a bit, felt it out and, upon landing, asked the owner if he couldn't fly it again soon, giving it a real test the next time. parachute and, while climbing into the lit- The following day he showed up with a tle plane, Albert remarked that he would put it through the paces, including outside looping it and the rest of the acrobatics.

The good little ship responded perfectly to the whims of its pilot and Roy was now climbing up for the supreme test of man and material. After reaching about 8,000 feet, Roy stuck the nose straight down and the little ship picked up speed immediately, roaring loudly on its downward plunge in a vertical power dive.

At about 3,000 feet, Roy figured he had sufficient speed and started pushing his stick forward. The tiny plane climbed fast in its inverted position, but could not quite make the top, stalled, and started to spin upside down. After making two turns, Roy brought it out and pointed its nose for the blue sky, reaching for more altitude again.

His second dive wasn't any more successful than the first, the Albert doing a half roll before reaching the top of the loop, stalled and was caught by Roy just in time to keep her from spinning. Evidently Roy was aiming to make one more attempt, for he started to climb back again.

He then reached what we figured about 10,000 feet and put himself into a straight long dive. When only 1,500 feet from the ground, at a time when we all decided he was bent on destroying himself and the ship in one grand dive into the earth, we suddenly saw the tiny plane (now very close and directly above us) start an abrupt, inverted climb as Roy pushed the stick forward at the last moment.

Long before the diving speed was spent in an upward climb we heard a loud "pop," saw the Albert suddenly stop dead, make one abrupt twist, the wing shifting to a crazy angle in relation to its body, and finally the whole thing roll over and over, falling to the ground on the far side of the field.

Apparently the wing could not withstand the terrific diving pressure and its trailing edge, sharp as a knife, hit Roy's head, knocking him unconscious or killing him even before the wreck hit the ground. He was gone before we reached him, and we knew that the mysterious Lady Luck would never ride as passenger for Roy Ahearn again.

A few months before the Gates outfit decided to disband, "Bucky" Steele, the handsome lad from down Georgia way, purchased a Waco 10 and was constantly crossing our path and mopping up the remainder of our passengers. When it began getting cool, Bucky decided to fly south

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Bob's Private Room

Here's Bob's room with an aeronautical atmosphere. Please note that P. A. stands out prominently in the foreground.

WE have a letter from "Just Bob" and a photograph of his room in Costa Rica.

The prop on the wall, Bob says, is the first prop in Costa Rica, but we doubt whether the gun is the first in this tropical land. Just above the prop is a transport pilot's license, which we infer has been granted to Bob. Sezze:

"It is very necessary to carry a gun in Costa Rica for a forced landing in this country is a heck of a thing. I use the gun, not for protection, but to shoot myself in case that I am forced down."

The Bird of Paradise Builds Forest

SURPRISED Hawaiian workers, employed in deforested areas of Kauai, have discovered an unknown forest which required quite a search through the files of the Governor of the Territory and the Commanding General of the Hawaiian Department before the mystery was cleared.

Seeds had been dropped from the Bird of Paradise, first plane to successfully negotiate the flight from the United States to Honolulu, piloted by Lieutenants Albert Hegenberger and Lester Maitland.

During 1929 three flights had been made over the area to be reforested and 1,689 pounds of seeds were dropped which explains the hundreds of sturdy young trees.

Radio Ray to Bring Down Airplanes

A RADIO ray, which it is claimed will bring down airplanes, has recently been developed by Guglielmo Marconi, inventor of the radio, and offered to the Italian air force, for anti-aircraft defense.

The ray is technically called the microwave, and consists of radio waves, or impulses, only 60 centimeters long. Such waves can stop the engines of airplanes flying high in the air and force them to descend to the earth. The machine has a range of 100 miles.

During a recent test, the engines of automobiles over a wide area were temporarily stalled, and could not be restarted until the rays were turned off.

Not So Safe in Europe

MANY Americans admit quite frankly that their first flight was made while travelling in Europe because it was "so safe." They definitely feel that because of the many automobile fatalities in America, flying too must be more dangerous here. But statistics show that, while American airlines flew a greater passenger mileage than all the foreign lines combined, twice as many passengers were killed on foreign airlines.

This fact and general comparative experience bring an announcement from Aero Insurance Underwriters that they will issue an Employers Aviation Indemnity Policy to persons using American airlines at a rate only two-thirds as high as granted on European lines, and that even this coverage is offered on a very few European airlines.

Actual War Photo

THE following picture is the first ever taken of a plane in action against a ship in actual warfare. The Spanish Government destroyer, Almirante Juan Fernandez, is sinking while the Rebel flying-boat overhead is directing gun fire from the enemy cruisers.

Only 40 men, out of a total crew of 175, were saved. The 40 were picked up by the French steamer Foutaoubia which happened to be cruising in the neighborhood.

Here we see the Spanish flying-boat hovering over the sinking ship, directing fire.

Swain Smashes Altitude Record

Adjusting Swain's altitude togs.

SQUADRON leader, F. R. D. Swain of the British R. A. F., recently smashed the airplane altitude record all to bits when he climbed his "mystery" Bristol monoplane to a height of 49,967 feet. This eclipses the French record of a short time ago by approximately 1,200 feet. The new record closely approximates ten miles above sea level which, however, is still about three miles below the record established by the stratospheric balloon "Explorer II."

Squadron Leader Swain, employed a special sealed oxygen suit for the flight which resembles, in many respects, the oxygen suit devised by the late Wiley Post. The air-tight rubber suit and the metal diver type helmet retained the oxygen supplied by the oxygen tanks.

Gliding Men Honored

MORE than 100 airmen wear the wreath-encircled three-gull button, marking the "D" certificate issued for motorless flight. First to acquire his "D" was Wolf Hirth, second Robert Kronfeld and third, Gunther Groenhoff.

There were but six members in 1931 who met the requirements of the flight of five hours duration with return to the starting point covering a distance of thirty-one miles, and an altitude flight to 3,280 feet above the starting point.

Lieut. Commander Ralph S. Barnaby, Earl Southee, Dr. Wolfgang Klemperer, Richard C. DuPont, Mrs. Warren E. Eaton, R. E. Franklin, J. K. O'Meara, Dr. Karl O. Lange, William Enyart, W. Hawley Bowlus, Donald Hamilton, William L. McGrath, F. K. Izzard, Youston Sekella, Stanley W. Smith, A. C. Haller, Charles H. Gale, A. L. Lawrence and Edward P. Warner are directors of the Soaring Society of America for 1936.

A Statistical Compilation of Aviation Data

WE have had so many requests, recently, for statistical data relating to the aviation industry that we have compiled the following table of valuable information.

It is quite interesting to find that the sum of the 15,763 licensed pilots and the 29,652 licensed student pilots, amounting to a total of 45,415 in all, far exceeds the total number of available licensed planes—9,621 in all. This indicates the immediate demand for a universal plane to which may be added the 10,000 persons who signified their intention of purchasing a plane within the next two years in a survey recently conducted by POPULAR AVIATION.

This is a potential market that is waiting for the appearance of a popular priced plane selling for, we should estimate, about $900. It is the same sort of potential market that was unlocked and satisfied by Henry Ford 'way back in 1907 at a time when cars were selling above $2,000.

Altogether there are 76 airplane manufacturers and 26 engine manufacturers, most of whom are employed on government or airline production. This brings the available licensed plane production slightly over 100 planes per manufacturer (total) or an average production of 21 planes per year per manufacturer. This situation, we believe, can be very quickly remedied by the production of a low-priced plane and by simplifying and revising certain government regulations.

Salient Statistics of Aviation Industry as of Oct. 1, 1936

(Compiled by POPULAR AVIATION)

	Aircraft					Pilots							
	Airplane manufacturers	Engine manufacturers	Licensed	Unlicensed	Gliders	Scheduled air transport rating	[6]Transport	[7]Limited commercial	[8]Private	[9]Amateur	[10]Glider	Airports	Government approved schools
Alabama	0	0	44	27	3	0	60	7	58	4	2	30	0
Arizona	0	0	55	10	1	2	35	4	54	9	0	47	0
Arkansas	0	0	38	15	1	0	45	3	34	0	0	31	0
California	18	5	889	115	48	122	1,217	111	1,460	134	9	192	7
Colorado	1	0	52	17	8	7	46	9	28	5	0	36	1
Connecticut	2	1	112	12	6	1	78	10	116	11	4	21	1
Delaware	1	0	35	0	0	1	15	0	20	0	1	5	0
Dist. of Col'bia	0	0	111	12	2	4	128	7	78	5	6	3	0
Florida	0	0	172	41	2	50	245	10	150	15	11	112	0
Georgia	0	0	66	43	1	20	82	4	57	2	0	51	0
Idaho	0	0	40	4	1	0	25	5	22	6	0	57	0
Illinois	3	1	552	50	22	109	453	39	423	40	7	60	4
Indiana	1	1	210	101	26	2	136	24	154	20	2	47	1
Iowa	0	0	142	30	4	3	91	14	87	1	0	39	0
Kansas	6	1	123	82	6	5	102	13	65	9	1	45	0
Kentucky	0	0	53	16	0	1	39	6	30	3	0	21	0
Louisiana	1	0	84	12	1	13	114	6	59	11	0	30	0
Maine	0	0	51	10	0	2	36	5	19	2	0	27	0
Maryland	2	0	88	36	3	0	72	7	79	5	0	21	1
Massachusetts	1	0	182	17	22	9	162	29	208	29	9	45	2
Michigan	4	4	310	104	45	11	306	37	277	50	8	114	0
Minnesota	1	0	166	56	10	22	153	29	55	7	1	35	0
Mississippi	0	0	59	13	0	0	23	3	25	2	0	26	0
Missouri	5	0	195	57	2	88	270	14	118	7	0	39	0
Montana	0	1	50	32	1	4	39	6	48	3	0	76	0
Nebraska	1	1	83	45	5	17	80	12	58	6	0	32	1
Nevada	0	0	13	8	0	0	6	1	8	4	0	22	0
New Hampshire	0	0	30	8	2	0	15	6	18	3	0	20	0
New Jersey	3	2	236	25	29	93	279	15	212	20	16	28	1
New Mexico	0	0	23	7	0	1	15	3	12	1	0	35	0
New York	9	1	850	49	48	8	602	114	726	90	27	100	5
North Carolina	0	0	81	50	0	0	63	2	52	4	0	30	0
North Dakota	0	0	48	27	0	1	39	2	22	1	0	47	0
Ohio	4	4	455	87	41	22	369	73	363	46	18	103	0
Oklahoma	3	0	180	37	2	3	120	15	116	7	0	49	1
Oregon	0	0	90	54	4	11	65	10	87	12	0	42	1
Pennsylvania	7	2	533	156	28	13	313	67	451	47	10	118	1
Rhode Island	1	0	38	1	1	1	16	2	26	2	1	9	0
South Carolina	0	0	28	28	0	1	24	9	19	0	0	29	0
South Dakota	0	0	63	11	3	2	33	8	37	3	0	26	0
Tennessee	0	0	74	20	3	20	77	6	107	2	0	25	0
Texas	0	1	369	164	4	64	485	37	240	31	0	135	1
Utah	0	0	33	4	5	12	40	4	24	2	1	24	0
Vermont	0	0	34	1	0	0	12	5	15	2	0	12	0
Virginia	0	0	92	30	2	7	176	12	73	3	3	40	0
Washington	1	0	146	27	13	14	164	22	135	20	1	54	0
West Virginia	0	0	60	7	1	1	38	14	45	8	0	26	0
Wisconsin	1	1	145	91	7	1	95	25	99	15	1	60	0
Wyoming	0	0	28	19	0	21	42	1	12	1	0	43	0
Alaska	0	0	74	2	0	0	56	3	10	0	0	83	0
Canada	0	0	1	0	0	1	6	1	10	0	0	..	..
Canal Zone	0	0	0	1	0	5	43	1	4	0	0	..	..
Hawaiian Is.	0	0	24	3	0	1	80	5	15	2	0	..	..
Mexico	0	0	0	0	0	0	6	0	5	0	0	..	..
Philippine Is.[2]	0	0	0	0	0	0	16	0	2	0	0	..	..
Foreign Misc.[1]	0	0	7	0	0	13	69	4	25	2	1	..	..
Totals	76	26	7,747[3]	1,874	413[4]	809	7,416[5]	881	6,752	714	140	2,402[11]	28

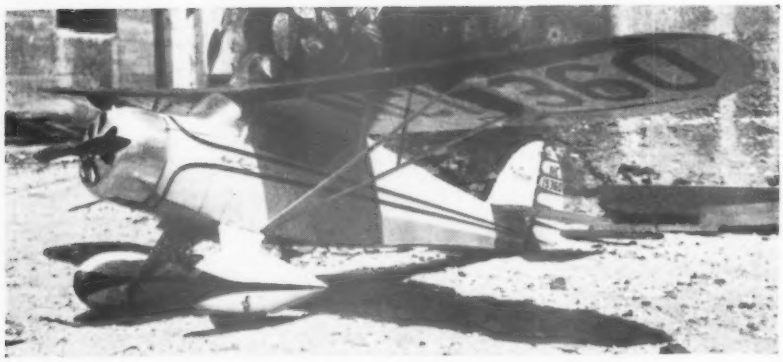
Total licensed student pilots: 29,652.

[1]Figures for these countries mean pilots and aircraft licensed or identified by the United States. [2]Civil aircraft in the Philippines are now registered with the local government. [3]This figure includes 45 licensed autogyros. [4]Only 39 of these gliders are licensed. [5]This figure includes the 809 pilots who hold scheduled air transport ratings. [6]69 women hold this license. [7]25 women hold this license. [8]278 women hold this license. [9]60 women hold this license. [10]2 women hold this license. [11]This figure includes municipal, commercial, intermediate, auxiliary, army, navy and miscellaneous fields; 701 of these 2,402 airports are partly or fully lighted.

XUM

Scores of Gas-Models Are

by
JOHN B. RATHBUN
Managing Editor of
POPULAR AVIATION



This realistic model of the Monocoupe is the handiwork of David Long and Rufus Condon, Fort Lauderdale, Fla. "Miss Lauderdale" is powered with a Baby Cyclone.

This model of the Wiley Post sportplane was built by Robert Mare, Columbus, Ohio. It is powered with a Loutrel gas motor which swings a 14-inch prop. It sure looks like its prototype, the full scale Wiley Post.

Here is an innovation in the way of a low-wing gas-model, built by A. C. Woerner. This is a daring scheme that deserves acclaim if it should work out satisfactorily.

OUT of the scores of gas model photos received at the offices of POPULAR AVIATION, we take pleasure in showing a few examples picked at random from the big pile. The remainder of the photos and specifications will be printed as rapidly as space and time permits.

If you will look over this collection of well designed and well built models and compare them with models shown in the issues of last year, you will note that a decided advance has been made in the art of gas model construction. And, again, not only has gas model design improved but the engines have also improved in point of reliability and efficiency.

Last year, gas model aviation was more or less an experiment with the greater majority of our readers although, of course, gas models have been flown by isolated individuals and groups for several years. The great big popular gas model movement involving the interest of thousands of young men has been of very recent development and is, indeed, still in its infancy. The price of engines has been reduced and more data is now available to the present day builder so that 1937 should see a veritable cloud of gas models in the air.

First, in the exhibition of photos, is a beautiful model of the Monocoupe, built by David Long and Rufus Condon, Fort Lauderdale, Florida. It is named "Miss Lauderdale" for obvious reasons. Its flying record, up to the time of writing, comprised two successful flights at 40 m.p.h. The landings at the end of these flights were quite normal and without damage, but the third flight ended in a slight crack-up when she landed in a tomato patch about a mile away. Miss Lauderdale is powered with a Baby Cyclone.

The wing span of this little ship is 6'-8¼" and the gross weight in flying order is five pounds. The main frame is principally of balsa and spruce with the ribs formed out of piano wire. The covering is silk, finished in cream with red trim.

Robert Mare, 154 E. Norwish Ave., Columbus, Ohio, has built a fine little biplane, a scale model of a Wiley Post sportplane which is known to the majority of our readers. The span is 6'-0" and the weight is approximately six pounds. Metal fittings are provided at all wing and landing gear-struts and also for the flying and landing wires so that they can be demounted quickly.

Wing spars, longerons, struts and the engine mount are of pine while the remaining wood parts are balsa. A Loutrel

XUM

Being Built by Our Readers

motor swinging a 14-inch prop constitutes the powerplant. As seen from the accompanying photo, this model seems almost of man-carrying lightplane proportions, but it is likely that the perspective has much to do with this effect.

Next, the low-wing gas model built by A. C. Woerner, catches our eye. At the time that this photo was submitted, the model had not yet been test-hopped, and we are very anxious to know how this experiment turned out as by far the greater majority of gas models are of the high-wing or parasol type. We print this picture for its novelty in design and trust that we will receive flight photos (or the reverse) for our next issue. Next on the program comes the ship built by James Dixon, 783 West 49th Street, Norfolk, Va. The design is that of a K.G.3. to which Mr. Dixon added a few of his own ideas.

Andrew Bonzko (this is the way we deciphered the name from his signature), hails from 1485 East 96th Street, Brooklyn, N. Y., and is remarkable for the very original design of his model. It is of the so-called "tailless" order with deeply swept back wings and is provided with a pusher type power plant. This arrangement, while it should give excellent stability, may not be quite so efficient as a straight wing job. Time alone will tell. In many respects, the wing layout much resembles that of the old Burgess-Dunne self-stable "Arrow," and if the proper amount of wash-out is given to the wing tips it should make marvelous flights and landings.

Peter Bowers, Los Altos, Calif., regales us with a view of his Corben Super Ace model, which indicates that Mr. Bowers is a long time POPULAR AVIATION reader. Mr. Bowers states that this little ship is a fine flyer with its longest flight ticked off at seventeen minutes. This, he says, was accidental due to the ignition timer and cut-off not functioning as it should have done. The ship kept on flying until its three-quarters ounce of gas supply finally gave out, finally landing in a field a few miles away.

Mr. Bowers states that a timer is a mighty fine thing to have on a gas job, as it makes the length of flight controllable, much more accurate than by measuring the amount of gas fed to the motor. He makes his timers from a Kodak self-timer placed below a tumble switch in such a way that the switch is opened when the timer plunger is released and springs up.

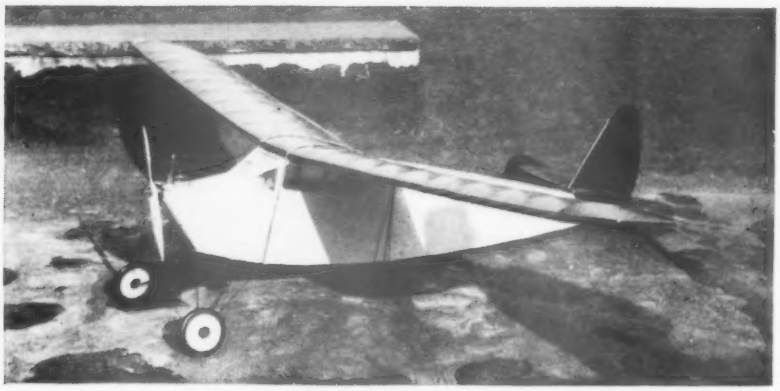
Richard P. Wolff, who says that he is an old-timer in the game of gas model flying, sends us a very interesting photo and an excellent account of his gas model. He has been in the business ever since Max Bassett made his famous flight from Central Airport, N. J.

It will be noted that the Wolff ship is very different in design from the majority of models. The model has a complete cowling system with every part streamlined to give the greatest possible reduction in resistance. He recounts his flights,

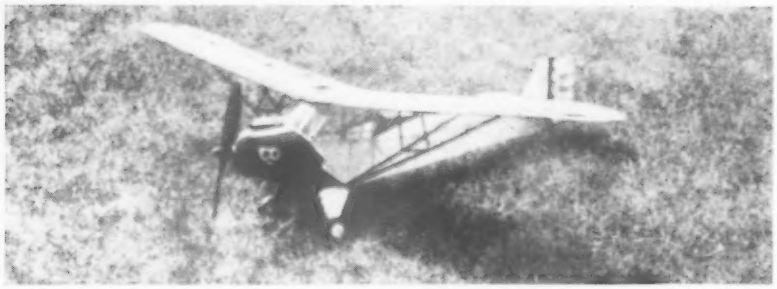
Here is another thrill in the way of an original gas-model. It is a tailless type constructed by Andrew Bonzko, Brooklyn, N. Y., who has vision and aggressiveness beyond the average model builder.

Peter Bowers, Los Altos, Calif., favors us with a view of his Corben Super-Ace gas-model which has already flown a duration of 17 minutes. Nice work, Peter.

Here is a mighty practical design built by an old-timer in gas-model aviation—Richard P. Wolff. It has an unofficial duration record of 21 minutes, 30 seconds on one ounce of gasoline. (Gasoline manufacturers please note.)



This is the recent reproduction of Henry Stadelmeirer, New York.



Jack Mitchell's job is a reconstructed rubber model.

C. W. Allen places his model in the lineup with the bombers.

And here is the fine little gas-job constructed by Mr. Dixon.

this year, at the Wayne County Airport as follows:

"My first unofficial flight resulted in a ground loop during the take-off. On the second flight, my plane was much more successful, getting away to an exceptionally short fast run on the cement apron. Then, lifting into the air, she circled up to the left, gaining altitude with unbelievably rapid climb.

"Up and up it went until it appeared as a small speck in the sky. I estimated that it went up to 1,500 feet and then, on running out of gas, glided back for a fine landing with an unofficial duration of 21 minutes, 30 seconds, on one ounce of gasoline.

"In the official flights of the afternoon, I was less fortunate because of motor trouble due to a weak spark in all of the three official tests."

And now, we have with us this evening, Mr. Henry Stadelmeirer, 132 St. Mark's Place, New York, N. Y., who presents a second photo of his ship to supplement a previous picture which, he says, does not do the model justice. And, on looking at this second picture, we'll admit that the previous picture did libel the appearance of the job.

Mr. Stadelmeirer disagrees with the contents of an article stating that the motor is best mounted lower than the upper longerons. In his opinion, although the motor gives a lower center of gravity, a higher line of thrust will give the model a better and more stable climbing angle. On the contrary, his motor is mounted very high in regard to the lower longeron and, by this arrangement, he has had climbing angles very near to the vertical.

His ideas seem to check out in practice for, after entering three contests, he has been in the first three places of each contest. He got third prize at the Junior Birdmens' meet at Lakehurst, first prize at the Bamberger meet at Hadley Field, and third prize at the Kresge meet, Caldwell, N. J. At the Lakehurst meet, the angle of climb was so steep that it appeared that the model was on the point of looping or stalling, but it came through in fine shape.

Jack Mitchell, 611 East Indian Street, Midland, Mich., shows an interesting job of reconstruction. He took a rubber powered model and converted it into a gas job by adding a 2-cylinder "Imp" engine. He claims that the flights have been very satisfactory.

C. W. Allen, of the 31st Bombing Squadron, Hamilton Field, San Rafael, Calif., sends a shot of his gas powered model, designed and built by him in his spare time. It flies very well and on its last flight, flew four minutes on eight eye-droppers of gasoline. The model is provided with adjustable stabilizers and rudder and has adjustable tabs on the wings.

The Allen model has a span of 6'-0", an overall length of 4'-1" and is provided with a tapered type wing. The weight, ready to fly, is 3.25 pounds and the powerplant is a Baby Cyclone 1/6 h.p. motor. It takes off within 75 to 100 feet and has a landing speed of approximately 15-20 m.p.h.

END

XUM

Choosing Model Wing-Sections

by RAOUL J. HOFFMAN

In this interesting and useful article, Mr. Hoffman shows the model builder how to determine the proper wing-section for his model to achieve desired results. This is of particular value to gas-model builders.

NUMEROUS articles have appeared on comparing characteristics of wing sections tested at high speed applicable to large airplanes only. But years ago wing sections were tested at low speeds-Eiffel, M.I.T., etc.—which are suitable for estimating model performances whether driven by gravity, rubber, compressed air or gasoline.

Nearly all the contests for models are conducted for duration only, and therefore speed ratio and landing speed—greatly analyzed for large airplanes—do not come within the scope of our investigations. We know that airplanes having the same stalling speed and the same power loading will have the same top speed, if any good wing section is used.

Nevertheless, the same laws will apply to models and airplanes in determining the power required to attain a horizontal flight. This power is equal to the energy required to lift an airplane with the same speed as it would descend (measured in vertical direction) if allowed to glide without power at the same angle of attack. This vertical descent, not the gliding speed, is called the sinking speed. Therefore, the lowest sinking speed will give you the minimum power required.

We may obtain slower descent with steeper gliding angle if the gliding speed is proportionally slowed down, because the sinking speed is a combination of gliding angle and gliding speed; or we may increase the gliding speed by streamlining the exposed parts, and the same time, owing to the reduced drag, flatten the glide and lower the sinking speed.

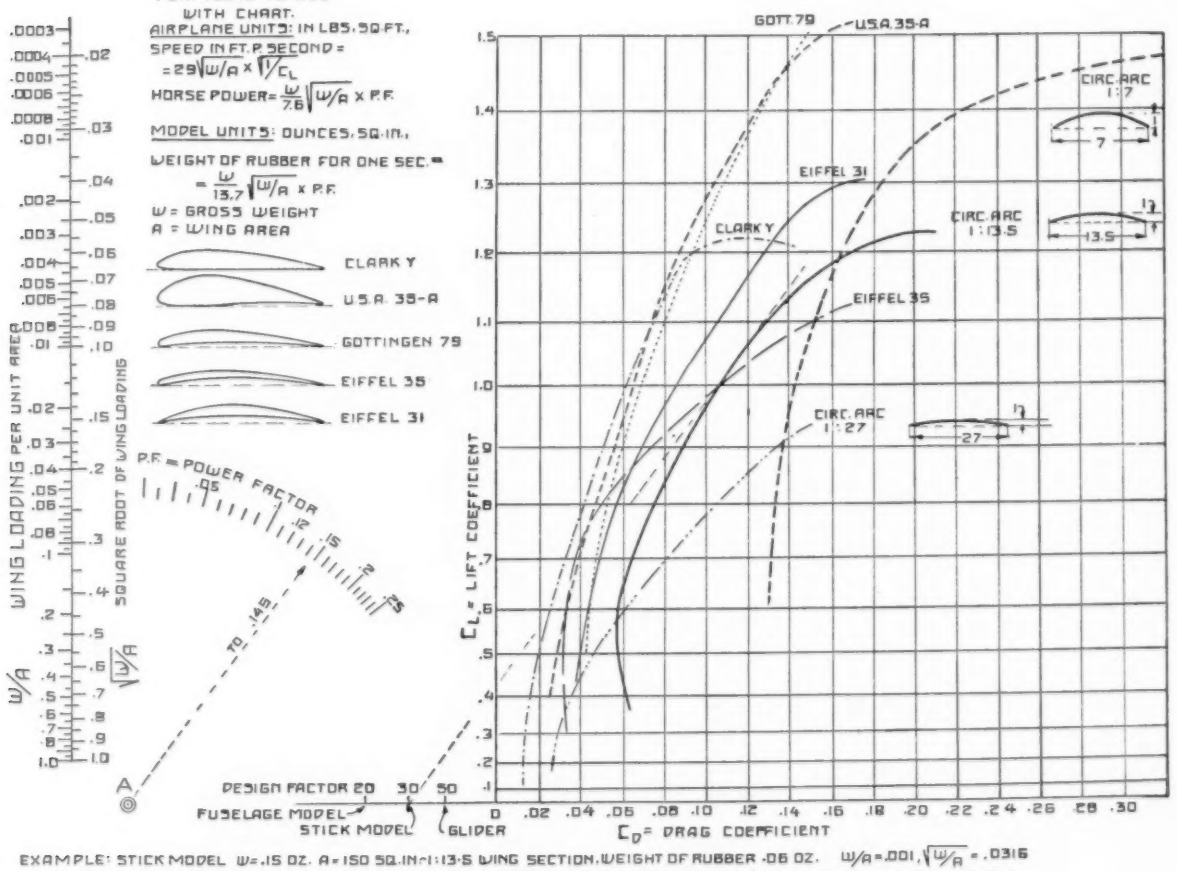
Another reduction in sinking speed can be obtained with the increase of the ratio of span and chord, the aspect ratio of the wing. The high aspect ratio may increase the weight of the wing to a point where no more reduction in power required is possible. A tapered wing is usually the solution of this problem.

The minimum power and the total energy carried by the model will determine the duration of the flight; therefore, the slower a propeller turns, the less power it requires under the same conditions. This is a simple method of comparing propellers for a finished model.

Then, adding the extra power available —as in rubber driven models—the model will climb to a certain height and after all power is expended it will glide to the earth; we may state that the duration obtainable with a minimum power in straight flight will be the same as obtained by letting the model climb and then glide, not taking propeller efficiencies into consideration.

(*Concluded on page 62*)

CHART FOR USE IN CALCULATING POWER REQUIRED FOR MODELS.



EXAMPLE: STICK MODEL $W=.15$ OZ. $A=150$ SQ. IN. 1:13.5 WING SECTION. WEIGHT OF RUBBER .06 OZ. $W/A=.001$, $\sqrt{W/A}=.0316$
MIN. WEIGHT OF RUBBER REQ. P. SEC $=\frac{.15}{13.7}\times.0316\times.145=.00005$. DURATION IN SEC. $=.06/.00005=1200$ OR 20 MINUTES.

THE ELF ENGINE FOR GAS MODELS

AS a result of published photos of the writer's Elf powered gas models, a great number of letters have been received asking further information on this very small gas engine.

The interest in it is apparently great and it is with pleasure that I offer this article disclosing the many fine features of this remarkable little 4 ounce engine. Beyond the engine itself, the thought of such a small gas model, in the minds of so many gas model enthusiasts, made possible through the use of an engine of such size, is indeed a big point in its favor to begin with.

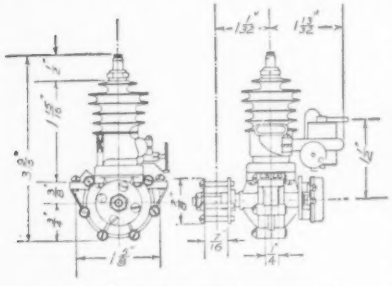
It is the writer's opinion that a small gas job is in no way less efficient in flight than the larger type, and its ease of carrying around is quickly realized. A model designed for this motor will have a wingspan of from 3 to 4½ feet and such a size range of models will weigh, ready to fly, from 12 to 28 ounces, depending upon the size and constructional methods.

The bore is .545 inch, or .017 inch less than 9/16 inch. It should be emphasized that this size engine is one of the very few, if not the only one, which has been a commercial success thus far, which is due to the highly skilled engineering and machining invested in it.

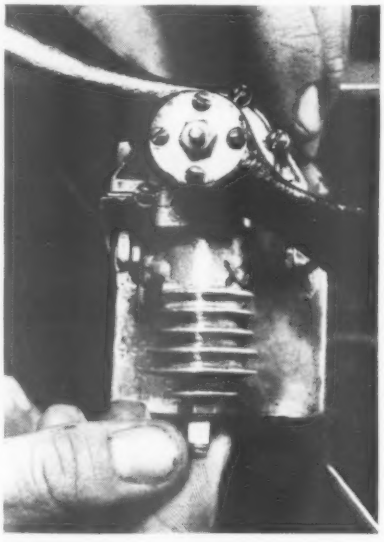
To further the readers' knowledge of various specifications, the stroke is 19/32 inch, while the piston displacement is 2.25 c.c. or about 1/8 cu. in. The maximum power developed is .035 H.P. at 4700 r.p.m. The speed at which it runs, as governed by the standard 12 inch diameter propeller of 6½ inch pitch, is 3500 r.p.m. The static thrust is between 8 and 9 ounces. The overall height of the Elf is 3 9/16 inches, while the overall width is 1 5/8 inches.

Contrary to general public opinion regarding the starting of an engine of such diminutive size, the Elf starts quickly and continues to run steadily after being correctly adjusted to two-cycle. This power plant, in comparison with its larger brothers, is very much easier to control and adjust after it has been started. Three cast iron piston rings are fitted to the piston, insuring nicely held compression. The gas-oil ratio is 12 to 1, which is entirely ample to meet its lubrication needs.

The use of booster batteries in starting this motor at the flying field is unknown to a user of the engine. The *two* crankshaft bearings undoubtedly contribute greatly to the excellent performance. Timing and carburetion are two phases of the engineering which are very noteworthy. The timer is of the automobile type, and is a beautifully constructed unit in itself.



Dimensions and scale layout of Elf engine.



Showing the extremely small size of the Elf engine compared with the hands.

It is completely enclosed. The position of this vital part is of great importance, as it is in the *rear* of the crankcase, which is after all the safest location, as far as the engine's safety in a crack-up is concerned. The carburetor is of the float type, which is rather uncommon in miniature engine construction.

The carburetion adjustment, a milled edge wheel on end of needle valve with ratchet, is located on the right side at the bottom, while the choke tube is extended around to emerge on the left side. The spark lever for spark advancement is located on the rear face of the timer mounting, extending on the right side.

The body of the engine itself, that is, the cylinder and crankcase, is of sand-cast aluminum, insuring great strength. In this connection, personal observations of it in complete model wash-outs can vouch for the high strength embodied in it, no damage ever being done beyond the usual broken prop.

The Elf runs approximately 40 minutes on one ounce of fuel at 3500 r.p.m. as allowed by the standard propeller. The cylinder liner is of thin steel tubing, and a 4 port exhaust is provided on the left side of the cylinder.

Its spark plug is perhaps one of the smallest yet developed, being built special for the engine, the insulator only being supplied special by the Champion Spark Plug Company. It has a ¼ inch-32 thread, and weighs 1/8 ounce.

A solid piece of drill rod is turned to form the crankshaft, which is fitted with steel counter-weights. Cast aluminum is also used for the piston and connecting rod.

(*Concluded on page* 54)

New Books

ENGINEERING AERODYNAMICS by Walter Stuart Diehl. Revised edition covers practical applications of aerodynamic theory to airplane design. 544 pages, 266 ills. The Ronald Press Company, New York. $7.00.

AIRCRAFT ENGINES, Theory, Analysis, Design and Operation by Arthur B. Domonoske and Volney C. Finch. Textbook for engineering courses and collection of valuable new material. 330 pages. John Wiley & Sons, Inc., New York. $3.75.

AIRPLANE AND ENGINE MAINTENANCE for the Airplane Mechanic by Daniel J. Brimm, Jr., and H. Edward Boggess. Covers the work of an aviation mechanic on a strictly trade basis serving as home study course for student mechanic, aid to instructor and student in secondary schools and reference and handbook for licensed mechanic. 490 pages, numerous ills. Pitman Publishing Corporation, New York. $2.00.

ONCE TO EVERY PILOT by Captain Frank Hawks. Stories of the breathless seconds in which America's greatest flyers thought they could not come out alive. 144 pages, illustrated. Stackpole Sons, New York. $1.50.

SKYWAY TO ASIA by William Stephen Grooch. Personal experience of expedition which created stepping stones for the China Clipper told by a recognized navy man and pioneering pilot. 203 pages, 30 ills. Longmans, Green & Co., New York. $2.50.

AIRCRAFT OF THE BRITISH EMPIRE by Leonard Bridgman. 103 excellent photographs of aircraft, 72 plans, together with specifications provided by the manufacturers. Sampson Low Marston & Co. Ltd., London. 5/ or approximately $1.25.

STRATOSPHERE AND ROCKET FLIGHT by Chas. G. Philp. Handbook on scientific principles of space flight of the future including a section on the problems of interplanetary space navigation. 116 pages. Sir Isaac Pitman & Sons, Ltd. London or Pitman Publishing Corporation, New York. 3/6.

Air Conditioning for Air Travelers

WHEN the passengers on the Pan American Airways' China Clippers land at Midway, Wake, and Guam islands, they will find that their food supply is kept fresh, delicious, and wholesome. Since the inauguration of mail service, Carrier air-conditioned refrigeration has been serving the operating personnel on those tiny, pin-point islands.

Carrier air conditioning will add to the comfort of the passengers who land at the Pan-Air do Brazil Terminal at Rio de Janeiro. The second and third floors of that new building will also be air conditioned for the further comfort of the passengers.

The Pan-Air do Brazil Terminal is a combined marine and land transport air base at "the finest aerodrome in the world," along Rio de Janeiro's famous water front, and within three minutes of the center of the city.

Building the Grumman Fighter

by
PAUL W. LINDBERG
Model Editor and Model Designer for POPULAR AVIATION

Here is the completed Grumman Shipboard Fighter model, a faithful and natural replica of the full size plane.

OUR model for this month features one of the Navy's latest shipboard fighters. All details have been highly developed in order to give you an authentic model in every respect. All controls are movable because of aluminum hinges. Due to improved streamlining, the Grumman performs beautifully.

COLOR SCHEME

Fuselage—silver with red band around fuselage behind cockpit.

Cowl—front red, rear silver.

Wings—lower panels all silver; top side of top panel—Navy Yellow; bottom side of top panel—silver.

Tail surfaces—green.

Details—black and silver.

CONSTRUCTION OF FUSELAGE

First, place waxed paper on top of plan to prevent parts from sticking to it. The fuselage sides are built from $\frac{1}{16}$-inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented by inserting straight pins on either side of strips wherever needed. When the two sides are completed, the crossmembers are cemented into their proper locations. Check carefully front to rear for alignment.

Cut the formers from $\frac{1}{32}$-inch sheet balsa and cement in their respective positions as shown on the plan. The position of all stringers is clearly shown on the formers. See plan. Work stringers from front to rear and check carefully to see that they have the correct spacing.

CONSTRUCTION OF MOTOR

To form cylinders, wind heavy thread around balsa blocks which have been cut and sanded to shape. The crankcase is made from two separate blocks. Rocker-arm, housings and pushrods are also made of balsa. Details of these parts are clearly shown on plan.

CONSTRUCTION OF WINGS

Cut all ribs from $\frac{1}{32}$-inch balsa. Pin the spar in position on the plan. Now, cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs. The panels carry movable ailerons which are a great help in controlling the flights. Make wing tips from $\frac{1}{16}$-inch balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.

ELEVATOR AND RUDDER

These are built from $\frac{1}{16}$-inch square and flat balsa, and are constructed on the plan. Their construction is very simple, therefore no difficulty should be encountered here.

LANDING GEAR

Study plans carefully and construct landing gear parts from strong balsa. Wheel well is made from balsa backed with balsa veneer or stiff paper. Reinforce all landing gear struts with piano wire.

COVERING THE MODEL

Apply tissue to the various framework members, using a light grade of model airplane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such upon a flat surface to keep from warping.

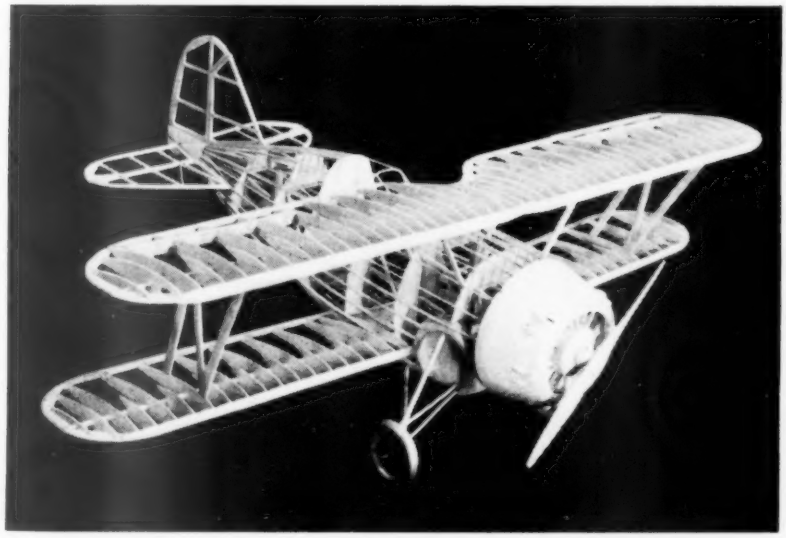
ASSEMBLY

After the landing gear has been attached to the fuselage, carefully cut to size all wing struts so wings will fit accurately in position. The elevator and rudder can now be cemented to rear of fuselage. All other details drawn on plan can now be applied. With an ordinary needle and thread all flying and brace wire are easily installed. Please keep in mind that the details add to the appearance of the model.

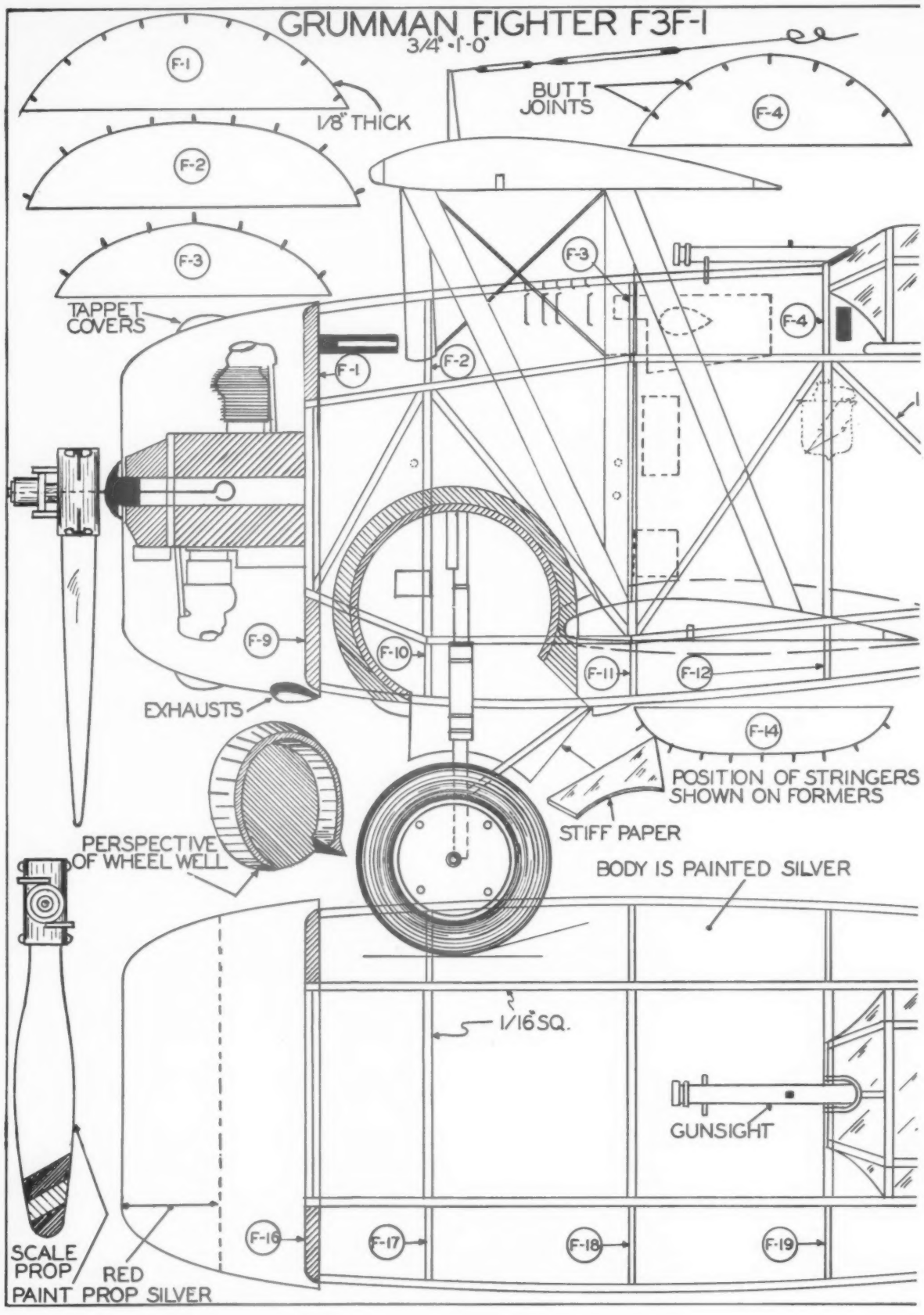
TESTING AND FLYING

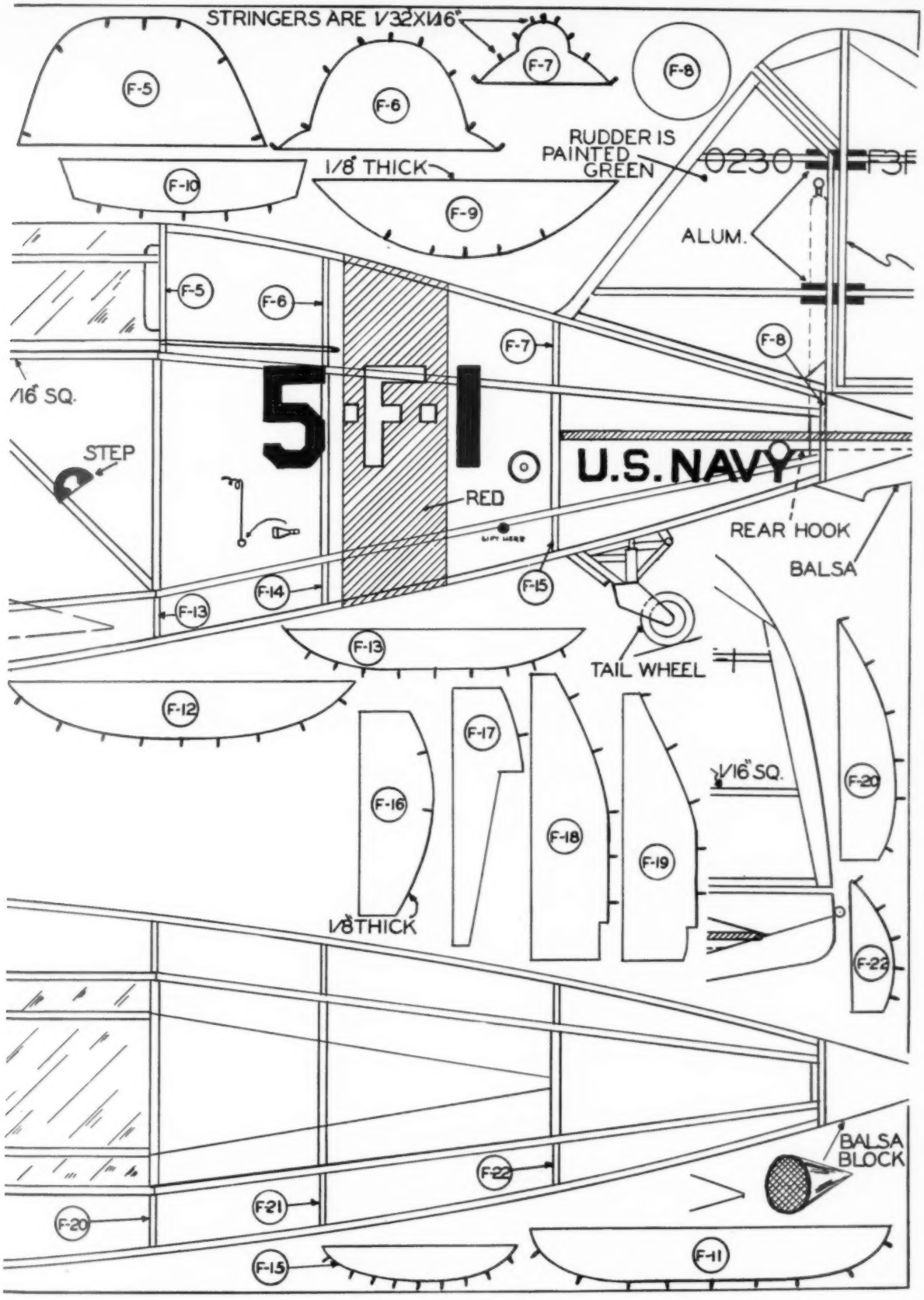
Two types of propellers are used on this model. One is made of fiber, which has a

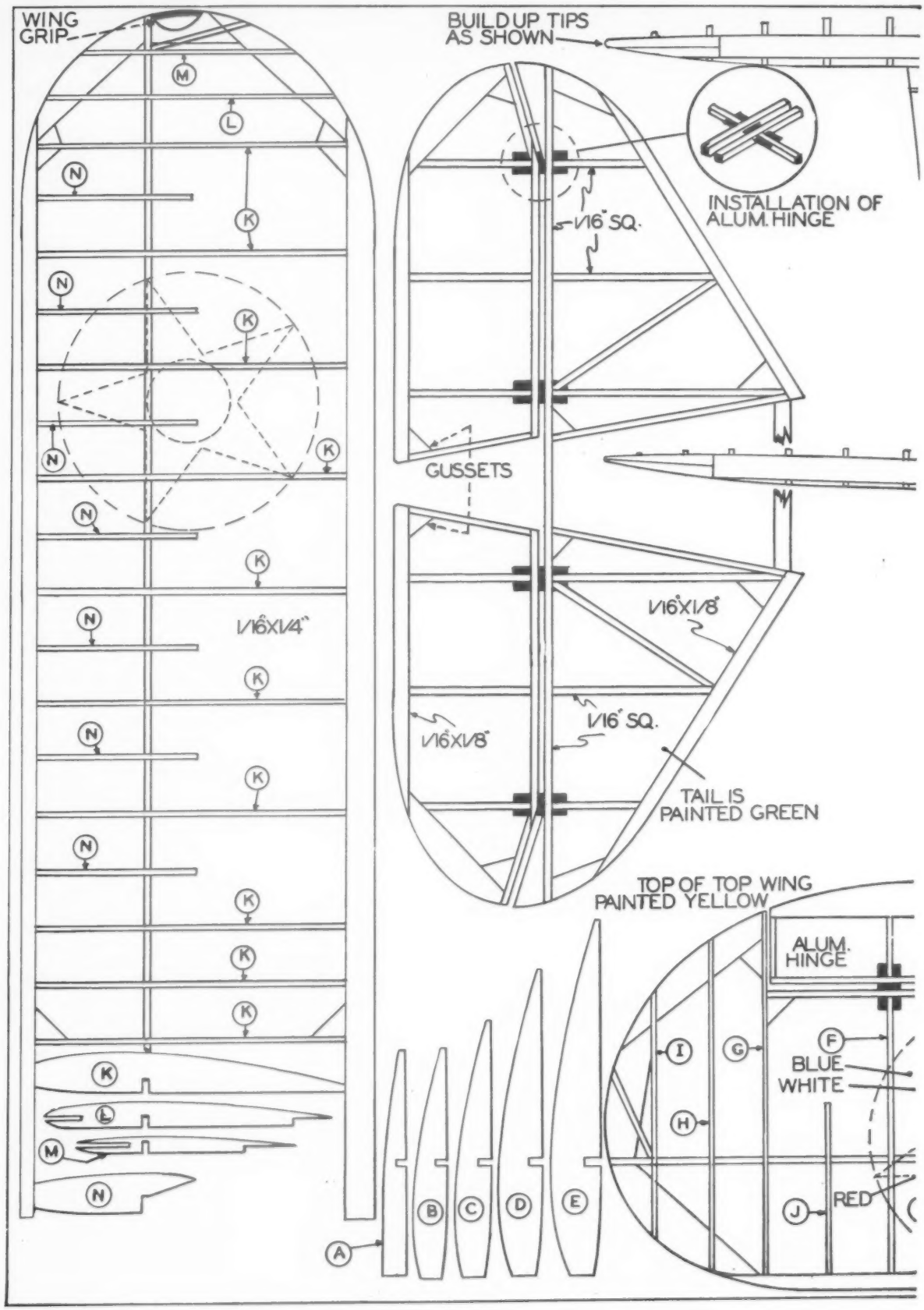
(*Continued on page 73*)

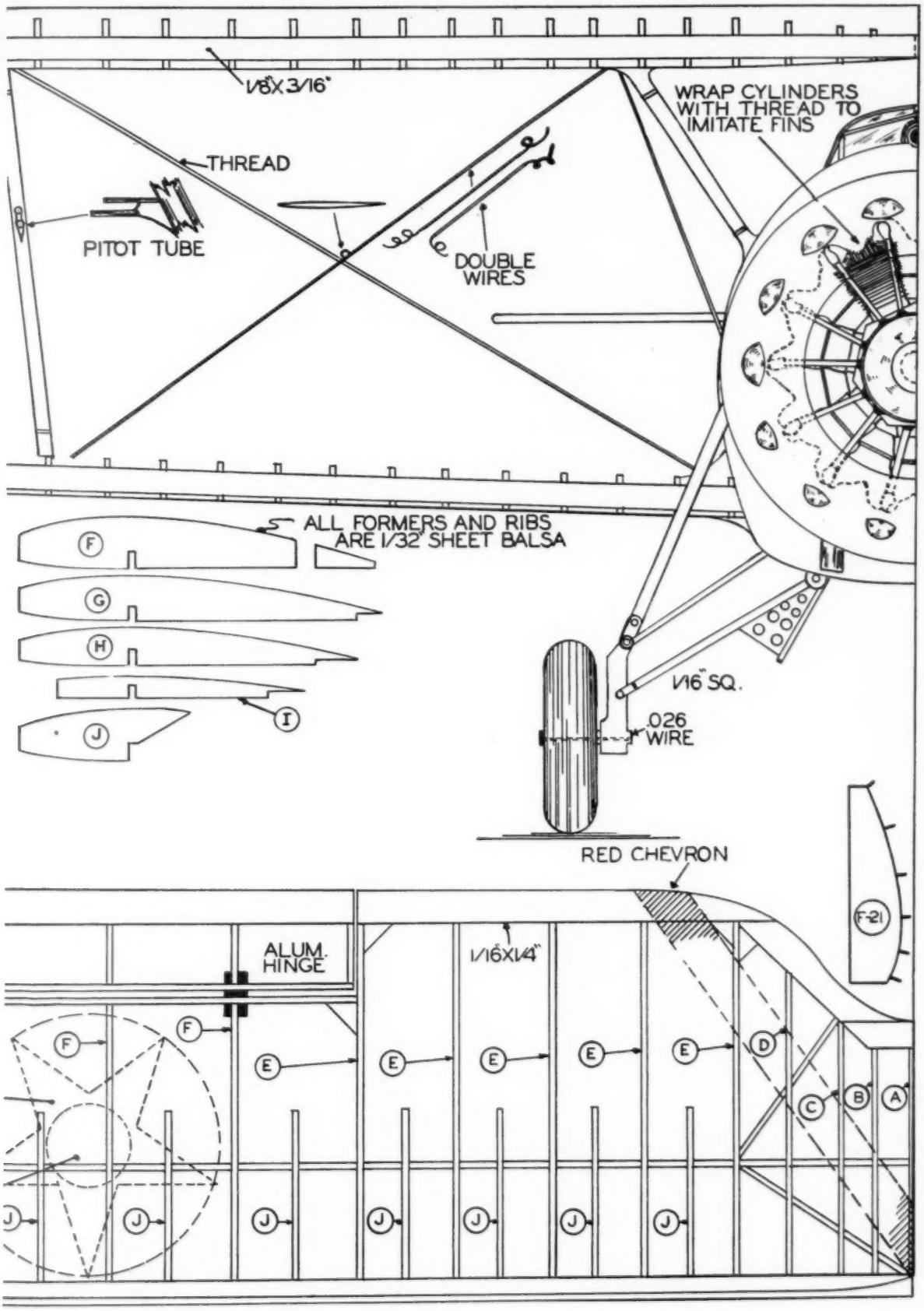


The framework of the Grumman Fighter completed but not covered.


GRUMMAN FIGHTER F3F-1
3/4" - 1'-0"
F-1
1/8" THICK
F-2
F-3
BUTT JOINTS
F-4
TAPPET COVERS
F-1
F-2
F-3
F-4
F-9
F-10
F-11
F-12
EXHAUSTS
F-14
POSITION OF STRINGERS SHOWN ON FORMERS
STIFF PAPER
PERSPECTIVE OF WHEEL WELL
BODY IS PAINTED SILVER
1/16 SQ.
GUNSIGHT
F-16
F-17
F-18
F-19
SCALE PROP
RED
PAINT PROP SILVER


STRINGERS ARE 1/32X1/16"
F-5
F-6
F-7
F-8
RUDDER IS PAINTED GREEN
1/8" THICK
F-10
F-9
ALUM.
F-5
F-6
F-7
F-8
1/16" SQ.
5-F-1
U.S. NAVY
STEP
RED
REAR HOOK
BALSA
F-15
F-14
F-13
F-13
TAIL WHEEL
F-12
F-17
1/16" SQ.
F-16
F-18
F-19
F-20
1/8" THICK
F-22
BALSA BLOCK
F-22
F-21
F-20
F-15
F-11


WING GRIP
M
L
N
K
1/16"X1/4"
BUILD UP TIPS AS SHOWN
INSTALLATION OF ALUM. HINGE
1/16" SQ.
GUSSETS
1/16"X1/8"
1/16" SQ.
1/16"X1/8"
TAIL IS PAINTED GREEN
TOP OF TOP WING PAINTED YELLOW
ALUM. HINGE
I
G
F
BLUE
WHITE
H
J
RED
A
B
C
D
E


1/8"X 3/16"
WRAP CYLINDERS WITH THREAD TO IMITATE FINS
THREAD
PITOT TUBE
DOUBLE WIRES
ALL FORMERS AND RIBS ARE 1/32" SHEET BALSA
F
G
H
I
J
1/16" SQ.
.026 WIRE
RED CHEVRON
F-21
ALUM. HINGE
1/16"X1/4"
F
E
D
C
B
A

Rockets

(*Continued from page 36*)

power into the same amount of relative propulsive energy as is possible at normal present day heights, speeds at least three times as great would be possible on the "floor" of the stratosphere, and up to thirty times as great at the "ceiling."

If, therefore, machines could be constructed capable of navigating the stratosphere, the resistance limitation of 660 miles an hour, hitherto regarded as insurmountable, would cease to be of importance for some time to come, and airplane speeds up to 1,000 miles an hour might reasonably be expected in the near future.

For this reason the problem of stratosphere flight was taken up so seriously that in a very short time every country of importance throughout the world was directing its best aeronautical brains to its solution.

Yet now, today, despite the use of larger, retractable, or telescopic wings; larger, or variable pitch, and variable area propellers; various forms of multi-compression superchargers; retractable undercarriages; and hermetically sealed cabins with air conditioning, or oxygen supply; no really tangible progress in actual stratosphere flight has yet been achieved.

A certain measure of success has, it is true, been achieved in the sub-stratosphere, as the well known "coast to coast" journeys of the late Mr. Wiley Post have proved, but flight in the stratosphere proper—the region first conquered by Professor Piccard in his ten mile balloon ascent—is proving to be a far bigger proposition than was first imagined.

The difficulties of getting a machine up into the stratosphere, or even into the sub-stratosphere, and when there, *of converting engine power with propulsive effect* are very great.

For it must be recollected, the airplane is essentially an "air machine," and it depends on the existence of air for its traction, lift, and engine in-take. Therefore, to expect it to function, in what is, for all practical purposes, an "airless" region, is scarcely logical. And the basic idea of taking an airplane into an airless region to obviate air friction is almost on a par with suggesting that a steamship be taken out of the ocean to obviate water friction! There is a growing belief, therefore, that the stratosphere proper, will remain unconquered, unless and until, some entirely new method of propulsion—one that will function regardless of the presence, or absence, of air—is discovered.

At the present time, the only method known to science of obtaining a propulsive effect in a vacuum, for such in effect are the conditions in the stratosphere, is the rocket (or reaction), principle of propulsion.

There is nothing new in the rocket—it has been used as a "firework" for hundreds of years—and it is only comparatively recently that Professor Goddard has been able to demonstrate to the world that the rocket *exemplifies,* not only a principle of motive power of tremendous proportions, but that it is also capable of producing its maximum effect in a vacuum.

In the stratosphere proper, the conditions closely approximate travel in a vacuum, and since no form of internal combustion engined airplane, depending on an "air-screw" for its propulsive action, can conceivably function in such highly rarefied regions, an entirely new science of "space" flight has recently come into being. This new science has been named "Astronautics," and is based upon the rocket principle of propulsion. It is rapidly assuming increasing interest and importance.

There can be no doubt that the exigencies of high speed travel of the future will *demand* the conquest of the stratosphere proper, and since the principle of reaction propulsion—as exemplified in the rocket—is definitely capable of producing a propulsive effect in a vacuum, it seems reasonable to suppose, that sooner or later, the resource and ingenuity of physicists and experimenters of all nations will succeed in evolving the necessary means and methods of converting this principle into practical effect, and will produce a machine which will achieve this epoch making advance in aerial flight.

END

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Now Practically An All Finished Flying Replica at the Price of a Kit!

One Hour Actual Building Time Will Give You This Easy to Assemble Snappy Flying Model Guaranteed to Fly Over 200 Feet

THE NEW SENSATIONAL

SELLEY-TEX

"MOTH" $1.50 Postage 15c

ALL FINISHED MOULDED ASSEMBLY KIT

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ALL WING SURFACES are made from a new light weight durable material MOULDED very carefully to the PROPER WING CAMBOR, rib impressions and slight up turned tips for added lateral stability. ALL MOULDED PARTS OF THE "MOTH" ARE ATTRACTIVELY AND COMPLETELY FINISHED IN A COMBINATION OF 3 BEAUTIFUL COLORS AND REQUIRE NO FURTHER FINISHING.

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1—**MOULDED CONSTRUCTION.** First real advancement in practical building.
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Each of these new moulded kits are incomparable in their individual price class. They are outstanding in value and **can not** be classed with any balsa-stick-kit. They are the most realistic and simple to build models ever created.

Every Selley-Tex Kit Contains:

The necessary moulded fuselage sides, cowl, pants, bombs, motor, etc., and are packed in a beautiful sturdy box.

Sawcut propeller, scale propeller parts, formed wire hooks, scaled wheels, brass bushings, printed out ribs on balsa, turned wood parts, tail wheel fork fittings, wire, para rubber motor, colored paper, Authentic markings, colored insignia, cement, colored dopes and easy to understand plans.

NEW AERONCA

16" Wing Span

50c *10c Postage*

I believe you have something that will make the Model World sit up and take notice. You are about ten years in advance of all other model companies and have beaten a path for the rest to follow. You have really contributed a worth-while thing to us modelers and I as one feel duly grateful. Lots of luck. Signed, Homer D. Corwin, Bismarck, N. D.

REARWIN

75c *15c Postage*

Wing Span 16" Length 10"

THANK YOU, MR. REARWIN!

REARWIN AIRPLANES, INC.,
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Gentlemen: One of our men set up the SELLEY-TEX Rearwin Speedster. He has built a great many models using both kits and blueprints, and says that the moulded forms for fuselage, pants, motor, etc., are exceedingly easy with which to work. I am keeping this model on my desk and everyone who comes in admires it greatly. It certainly is realistic looking.
(Signed) KENNETH REARWIN

VOUGHT CORSAIR, JR.

Wing Span 18" Length 13¾"

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OUR GUARANTEE EVERY SELLEY-TEX KIT MUST SATISFY OR MONEY REFUNDED

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"Your method of accurately forming the major parts of a model mechanically seems to simplify the art to such a degree that anyone now can be a successful model builder."
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"With your new moulded process, I would judge, almost anyone should be able to make a successful flying model."
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Signed, Geo. F. McLaughlin, Editor.

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"The Lockheed Orion kit I constructed looks like a prize contest winner to me. I think SELLEY-TEX is the greatest bargain ever offered on the market."

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Elf Engine

(*Continued from page 46*)

The accessories developed for the engine are of course light in weight themselves. The combined weight of the spark coil and condenser is 2½ ounces. Two fountain pen cells are standard for the ignition system, having a combined weight of 1 ounce.

It is entirely possible to use one standard size flashlight cell or if desired, even the intermediate size between the two, if a longer lasting battery than the fountain pen type is desired. Considering the total weight of all the items of the operating unit, it is found that the complete outlay will weigh (including propeller, wiring, battery holder, etc.) about 9 ounces.

An Elf may be inverted very easily, running just as efficiently in this position. As a matter of fact, one rarely sees it installed upright in a gas job, for obvious reasons known to gas model designers. A special carbureter is available for inverted running, as otherwise it would have to extend out to one side if the upright style were retained for running inverted.

In conclusion, the additional feature of being able to maintain the fuel tank over the center of gravity of the plane is most important in helping towards a perfect balance of the ship, after the gasoline has been consumed. The tank may be placed any distance from the engine, provided it remains at least ½ inch above the top of the carburetor float chamber. ⅛ inch O.D. rubber tubing serves as the fuel line.

The propeller mounting method, though seemingly of minor importance to the layman, is invaluable to the user in maintaining an easily operated gas model, inasmuch as its slipping on the mounting flange is impossible.

The only wish of the writer is that this article may be the nucleus for future well-deserved recognition of this excellently constructed and engineered engine, in the Miniature-Gas-Engine Hall of Fame.

END

BIG MONEY Assembling NEW MEAD KI-YAK at Home!

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MEAD'S complete cut-to-fit KI-YAK Kit easily assembled for pleasure or profit! Can't sink. Portable. Seaworthy... Light... Fast. Highest quality. Low cost. Opens a new world of sport for you both in sailing, paddling. Also Outboard model. Rush 10c for illustrated folder. $6 Paddle now given with KI-Yak—Hurry!

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Northwest

(*Continued from page 28*)

by a 500 H.P. Hornet motor that gave a cruising speed of 120 miles per hour. These planes accommodated seven passengers and a pilot.

Northwest Airlines has been well ahead of competing companies in many other respects. It was one of the first to install radios in its ships, one of the first to adopt metal skis for mail planes—thus assuring delivery in any type of weather, and has constantly been a leader in the use of up-to-date safety devices of all types.

The million-dollar northern air route over which the planes of Northwest Airlines operate was built under the direction of the U. S. Bureau of Air Commerce and has been extensively employed by the government as an experimental line, serving to introduce many of the improvements in air transportation that have since been universally accepted.

From a business standpoint, the construction of this airline has been a great boon to the Northwest, bringing to it thousands of travellers and vacationists, and providing the ultimate in transportation to all the people of these states. But also, through its progressiveness and constant improvement, Northwest Airlines has made a tremendous contribution to the whole development of aviation in this country.

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OF TECHNOLOGY

Compass

(*Continued from page 31*)

This was very disconcerting in flying by instrument, prior to the development of the Sperry directional Gyro. This has eliminated any danger from this source.

The center of gravity of the card is below the point of support, thus it acts somewhat like a pendulum. The vibration of the point of support will thus cause deflections of the compass card and in exaggerated instances spinning of the card. New anti-vibrational mounts have eliminated this error to a large extent.

If the axis about which the card rotates is inclined to the vertical the vertical component of the earth's field comes into play tending to rotate the card as previously explained. The compass is thus unreliable under all conditions where the card is tilted.

The most important of the errors of the aircraft compass is that due to the magnetic disturbances set up by the plane structure. These disturbances have to be balanced so that the compass lies parallel to the surrounding magnetic field. This balancing is called compensation and is of prime importance to accurate aerial navigation. A method employed to compensate compasses in the Navy will be described in detail.

A compass rose is laid out on a concrete base with a turntable arrangement for rotating the plane. The rose is constructed for magnetic headings. The difference between the magnetic headings and the true headings equals the magnetic variation of the locality. The rose is located well clear of any outside influences, such as steel hangars. The accompanying sketch shows a plan view of a rose. The plane is placed on the rose in normal flight attitude, the tail being raised to the correct height on a horse. This height may be obtained from the manufacturer's erection instructions.

The plane is first placed on the magnetic heading 90 degrees. The axis of the plane is lined up with the line on the rose by means of two plumb bobs attached to the plane. One is on the propeller hub and the other on the after end of the plane.

The plane is equipped as it will normally fly. All loose equipment is in its correct place. The radio sets are turned on. Make certain there are no loose tools in the cockpit or in the vicinity of the compass. The compass is then read, for example, the reading was 93 degrees. The deviation is three degrees westerly. By means of the east west compensator the compass is made to read 90 degrees. The plane is then swung to 180 degrees and lined up as before. If the reading is off the compass is made to read 180 degrees by means of the north south compensator. The plane is then swung to 270 degrees magnetic. If the reading is off the error is halved, for example, it read 266 degrees.

By means of the east west compensator the reading is brought to 268 degrees. The same procedure is followed on the northerly heading, the error being halved by means of the north south compensator. The compensation is completed and the plane is then swung every thirty degrees to obtain a table of deviations. The differences on each heading are recorded and a table is placed in easy view of the pilot for use when flying.

When swinging for this residual error, if there are any headings on which the error is more than five degrees, the plane must be searched for some excessive magnetic disturbance.

This is best accomplished by means of a pocket compass. There have been instances of highly magnetized center section struts, longerons and even the attachment on the control stick for firing, creating errors as high as thirty degrees on a heading. The curve of deviations of a normal compass should be approximately a sine curve.

END

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from the largest manufacturer of
MODEL AIRPLANE ACCESSORIES
in the world

Bambs and TORPEDOES
13/16" ... 5c
1¼" ... 8c
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Die Cast New Guns
WITH RING MOUNT
1¼" long B 25c
1¾" long A 30c
SWIVEL TYPE GUNS C
2" Double Action 15c
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⅝" long.... 5c
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TYPE E
1⅝" long.... 10c
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1¼" long 10c
G DUMMY RATCHET GUN
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DUMMY MOTORS
Something New
9 Cylinder
1" dia. 30c
1½" dia. 50c

WHEELS

Aluminum Disc Rubber Tired Wheels
½" dia. .... 5c ea.
⅝" dia. .... 6c ea.
¾" dia. .... 7c ea.
⅞" dia. .... 8c ea.
1" dia. .... 9c ea.
1⅛" dia. ....10c ea.
1¼" dia. ....11c ea.

Balloon Tire Alum. Disc Wheels
1½" dia. ....25c pr.
1⅝" dia. ....28c pr.
2" dia. ....30c pr.

Treaded Rubber Tire Aluminum Disc
1 3/16" dia. .30c pr.
1½" dia. ... 40c pr.
2" dia. ....50c pr.
3" dia. ....60c pr.
5⅛" dia. ...$1.50 pr.
6½" dia. ...$2.00 pr.
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Axle Fork and Swivel Joint
½ up to ⅝" wheel 10c
⅝ up to ⅞" wheel 15c

SEND 5c FOR CATALOG

Aluminum Disc Rubber Tired Air Wheels
1" dia. ....15c pr.
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Celluloid Wheels / Balsa Wheels
⅝" dia. 06c pr. / 04 pr.
1" dia. 08c pr. / 05 pr.
1⅜" dia. 10c pr. / 07 pr.
1⅝" dia. 18c pr. / 10 pr.
3" dia. 35c pr. / 35 pr.

Balloon Tired Celluloid Disc Wheel
1½" dia. ....30c pr.
1⅝" dia. ....33c pr.
2" dia. ....35c pr.

AXLES Threaded and fitted with washers, bushings and nuts.

Lengths	1/16	3/32	1/8
2"-5"-6"	12	.10	.20
7"-8"-9"	14	.12	.23
10-11-12"	18	.15	.25

Postage 3c per pair, on Rubber Tired Wheels, 4c pair

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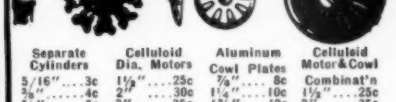
3½"	25c	4"	35c	1½"	8c	1½"	10c
4"	30c	4½"	45c	2½"	10c	2½"	12e
4½"	35c	5"	50c	3½"	15c	4"	25e
5"	35c	5⅝"	60c	4"	20c	4½"	35c
5⅝"	40c	6¼"	70c	4½"	25c	5"	45c
6¼"	40c	7"	80c	5"	30c	6"	60c
7"	55c	8"	90c	5½"	35c	7"	70e
8"	65c	9"	$1.00	6"	40c	8"	80c
9"	75c	10"	1.10	6½"	45c	9"	90c
10"	85c	11"	1.25	6⅝"	50c	10"	$1.00

Props can be had up to 24 in. dia. Postage 6c each.

CELLULOID MOTORS Postage 3c



Separate Cylinders		Celluloid Dia. Motors		Aluminum Cowl Plates		Celluloid Motor & Cowl Combinat'n	
5/16"	3c	1½"	25c	⅞"	8c	1½"	25c
¾"	4c	2"	30c	1¼"	10c	1½"	25c
⅞"	5c	3"	35c	1¾"	12c	3"	35c

Spun Aluminum COWLS

	Drag Ring	Open Face	Closed Face
1"	15	15	15
1⅛"	18	18	18
2"	20	20	20
3"	28	28	28

Authentic 2¼"x4¼" Airplanes

24	ARMY	25c Set
18	NAVY	25c Set
16	WARTIME	25c Set
84	SQUAD. INSIG.	25c

Dummy Turnbuckles
¼" ....10c each ⅜" ....10c each ½" ....10c each

IMPORTANT—Minimum order, 50c. Add postage on all items but if over 15c on less than $1.50 order add only 15c. Orders over $1.50 add 10%; west of Denver 15%.

SELLEY MFG. CO.
1373 GATES AVE., BROOKLYN, N. Y.

XUM

The BIGGEST XMAS THRILL- AN ENGINEERING TRIUMPH...

FREE

1 finished flywheel mounted on motor with every finished motor

$12.50 Postpaid

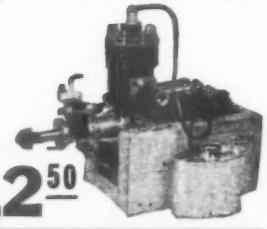
The thrill of a lifetime may be yours this Christmas with a G.H.Q. assembled, ready-to-run, super-power gas engine—actually one of the most powerful motors ever constructed. Yet never in the history of gas engines was a motor ever offered at so low a price! All America has acclaimed this engineering triumph accomplished by outstanding G.H.Q. engineers after years of exhaustive, scientific, aero-dynamic research. It's the modern miniature motor designed exactly as present-day real motors and has broken records for amazing performance.

G.H.Q. Motor Gives You Long Wear

And look at the reason! In many cases we could have saved considerable money using inferior weak parts. Examine each part closely. Look at the lifetime, high speed bronze connecting rod—and the crank shaft 5/16" thick as compared to other motors selling at twice the price having a thickness of only 3/16". Then, too, G.H.Q. has one of the longest crank shafts on any motor—as well as the fool-proof long-life timer. And look at the next page for 24 extra, exclusive features!

G.H.Q. Motors Attain Highest Possible Degree of Perfection

And each motor is uniform in every respect. Our tremendous output (thousands of motors have already been bought), together with the fact that we are one of the largest concerns of its kind in the model airplane field, is your assurance that each G.H.Q. motor conforms to the same uniform high standard of performance. Because we are vitally interested in justifying your every confidence, we have spared no expense in modern factory production—enabling us to fulfill every claim you read.



The Price Is So Low—We Can't Sell Dealers

The G.H.Q. Motor is priced especially low so that you may deal direct with our factory. Even though dealers have asked to handle this product, we have not been able to give them a special dealer's price. This famous motor, complete entirely assembled on stand, tested and run before shipment, performance guaranteed. No oil, gas or batteries included. Free—one finished fly-wheel mounted on motor with every finished motor. Postpaid for only **$12.50**

And Don't Forget These Record-Breaking Values!

5 ft. Flying Scale Models $1 1/3 size of real planes!

EACH
PLUS 35c for PACKING, POSTAGE & INSURANCE
IF EXPRESS COLLECT SEND ONLY $1.00

These are the giant models that have amazed the model builders of America. Imagine strong outdoor flyers that are actually one-third the size of passenger carrying planes—a $10 value for only $1.00. Everything is in the kit including all liquids—nothing else to buy!

CONTENTS: Each of these new G.H.Q. Giant 5 ft. Model Planes contains full-size Plans, all ribs, formers and curved parts clearly printed on best grade Balsa. Large bottles Cement and Dope, different colors Japanese Tissue, Special Endurance Rubber, finished Ready-Cut 3" Wheels, Wire, Balsa strips cut to size, Washers, and . . . Movable Controls, shock-proof Landing Gear, Scale Details, Lettering, Numbering and Insignias, Flight Log, etc.

5 ft. Monocoupe

5 FT. STINSON RELIANT

Also HEATH PARASOL

36" FLYING SCALE MODELS 50c

plus 20c packing, postage, insurance

G.H.Q. Scale Models are the best Kits your money can buy for appearance and flights. Buy one today and you'll buy a whole fleet of them. Get acquainted with G.H.Q. Kits and no others will do.

36" Northrop Gamma "Sky Chief" 50c

Also 36" Douglas Y-10 . . . . . 50c

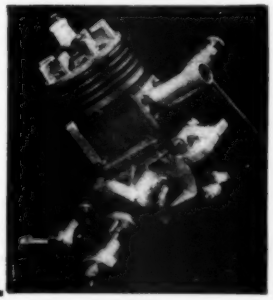
36" Curtiss A-8 Attack 50c

G.H.Q. Ready-to-Run GAS MOTORS

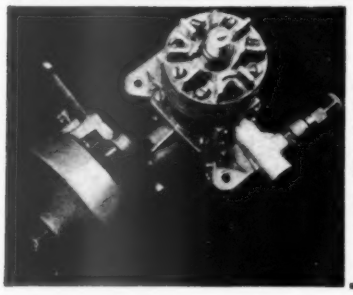
Never before a Motor at so low a price!

These Features Make The G.H.Q. Gas Motor A Winner!

1 Easy to start.
2 Steady running—as long as gas, oil and spark are supplied.
3 Motor cannot overheat.
4 Precision parts.
5 All parts replaceable.
6 Cylinder and piston lapped.
7 Accurate die castings.
8 Crank shaft balanced and perfectly machined.
9 A light spark coil that is oil, water and gas proof.
10 Coil will not overheat or shortcircuit.
11 Main bearing is high-speed bronze, ground and lapped to size.
12 Condenser is gas, oil and water proof.



13 Cylinder and piston inspected cast iron to insure long life.
14 Chrome nickel steels haft with 1⅛" bearing surface.
15 Connecting rod of high speed bronze.
16 Carburetor assembly accurately designed and made.
17 Needle valve and valve body machined together.
18 Breaker assembly compact, fool-proof, long wearing, replaceable and adjustable.
19 Easily inverted and runs in either direction.
20 Motor starts and runs on 2-ounce battery.
21 Speed range 500 to 10,000 R.P.M.
22 Low gas consumption—runs 27 minutes on one ounce of gas.
23 Strongest miniature motor.
24 LOWEST PRICE EVER SET.



"Motor Is Running Perfectly"

New York City,
Oct. 15th, 1936.

G.H.Q. Model Airplane Co.,
854 East 149th St., New York City.
Gentlemen:
I wish to thank you on the wonderful service you gave me.
The motor is running perfectly in every way and it certainly lives up to every claim which you made. It is worth at least three times the price.

Yours very truly,
VICTOR PETROVICI.

G.H.Q. GAS KITS

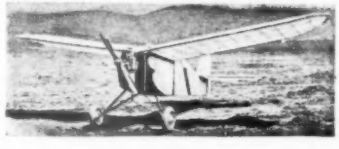
Here is your opportunity to obtain a kit of this famous motor. Assemble it yourself and save money. Easy to assemble.

Everything is in the kit including plug, coil, condenser, tank, ignition wire, cylinder, piston, connecting rod, timer, crankshaft, all screws, nuts, bolts, etc. No oil, gas, batteries, or propeller included.

$8.50

Postpaid for only.....

G. H. Q. Sportster Kit



G.H.Q. Sportster kit specially designed for G.H.Q. Gasoline motor but may be used for any other motor of like weight and power. Built according to scientific aero-dynamic principles —Has made hundreds of successful flights without crackup—Marvelous glider . . . And what a climber, 4 hour flights are common! A complete kit of all parts including plan, all wood, wire, wheels, metal and other parts. Postpaid for only **$5.00**

G.H.Q. Model Airplane Co.

854-P East 149th St. New York, N. Y.

STANDARD WARRANTY

"We warrant each new G.H.Q. gasoline engine manufactured by us, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory, any part or parts thereof, which shall, within ten (10) days after delivery of such motor to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to ours atisfaction, to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our G.H.Q. gasoline engine."

PERSONAL DEMONSTRATION

If you reside in New York area or come to the city we shall be glad to give you an actual demonstration of a finished motor.

ORDER TODAY

or send 3c for illustrated catalog of gasoline motors, gasoline planes, gasoline accessories and parts.

Order by coupon or letter.

G.H.Q. MODEL AIRPLANE CO., 854-P East 149th St., New York, N. Y.
Enclosed find $..... Please send the following as checked.

G.H.Q. Ready-to-Run Gas Motor	$12.50
G.H.Q. Gas Motor Kit	8.50
G.H.Q. Sportster Kit	5.00

12" SOLID KITS — 15c Each Postpaid
- ☐ Boeing 247D
- ☐ Ryan Racer
- ☐ G.A. Coast Guard Amphibian
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- ☐ Fokker D-7
- ☐ Polish Fighter
- ☐ Monocoupe
- ☐ Falcon
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Aviation Januaries

(*Continued from page* 16)

Graham Bell, Ernest L. Jones, sec. Aero Club of St. Louis formed to manage the INTERNATIONAL BALLOON RACE, with L. D. Dozier, president, and A. B. Lambert, honorary secretary.

1908. World agog over the December advertisement of the American War Department for bids on a FLYING MACHINE to meet certain conditions thought impossible, resulting in the purchase of the Wright, the only machine to appear. Albert C. Triaca announced his school of aeronautics in New York, FIRST AVIATION SCHOOL in America.

1909. The FIRST CIVIL AIRPLANE TRANSACTION in America was the order of the Aeronautic Society in New York to Glenn Curtiss for the production of a plane, flying it in a public demonstration and teaching a member pupil, following the success of the *June Bug* of Dr. Bell's Aerial Experiment Association. The machine was delivered in the Spring and Charles F. Willard became America's first exhibition flyer.

Curtiss' flying of this machine resulted in rushing to France a duplicate with more horsepower to win the Gordon Bennett first international airplane race. His success there and in Italy launched Curtiss and his associates in a great airplane and exhibition business. In the same month was formed the Aero Club of Indiana with Carl G. Fisher as president.

1910. Jan. 10-20 was held America's FIRST AIR MEET under the auspices of the Aero Club of California at Los Angeles, featuring Louis Paulhan with 2 Farmans and 2 Bleriots. Curtiss had his Rheims machine and 2 others, Willard the "Golden Flyer" of the Aeronautic Society.

Charles K. Hamilton had a Curtiss, Hillery Beachey a Howard Gill. Knabenshue and Lincoln Beachey flew their airships. Here Paulhan established a NEW ALTITUDE RECORD of 4,165 feet. Three more aero clubs started.

In the East, the Aeronautic Society and the Aero Club each acquired flying fields at Mineola and Garden City and established Long Island's prestige as a flying center. In the same month Frank E. Boland started flying, which resulted in the Aeromarine company of I. M. Uppercu.

1911. Jan. 18. For the first time in history Eugene Ely LANDED AND TOOK OFF A SHIP'S DECK, using ARRESTING GEAR arranged on a cruiser—pointing to the aircraft carrier of today. Also during the San Francisco meet Jan. 7-25 P. O. Parmalee (Wright) made new AMERICAN ENDURANCE RECORD of 3:39:49.

Didier Masson demonstrated AIR NEWSPAPER ROUTE by flying the *Times* from Los Angeles to San Bernardino. Extensive AIR SHOW held with the automobiles at Grand Central Palace, New York, including exhibit of a Simms airplane ENGINE STARTER.

On Jan. 26 Curtiss made FIRST SEAPLANE FLIGHT in America at San Diego—the introduction of seaplanes for fleet use. On the last day J. A. D. McCurdy made new American CROSS COUNTRY RECORD of 89.78 miles from Key West to Havana during Havana air meet.

1912. Third LOS ANGELES MEET with receipts of $41,058. Contestants: Lincoln Beachey (Curtiss), P. O. Parmalee (Wright), Glenn L. Martin (Martin), J. C. Turpin (Wright), Farnum T. Fish (Wright), Howard W. Gill, Weldon B. Cooke, Rutherford B. Page [killed during the meet], Stevens, Harvey Crawford, Frank M. Stites and Carlstrom.

From this affair grew the fame of Lincoln Beachey. More engine starters appeared on the market and Riley Scott began trials of his FIRST BOMB SIGHT AND DROPPER in preparation for Michelin Prize contest.

1913. Weldon B. Cooke flying with INVERTED ENGINE, a Roberts 2-cycle. Preliminary trials of Curtiss tractor with CHAIN DRIVE. FLYING BOAT type of waterplane becoming popular and in the Benoist the engine was placed in the hull with chain drive to prop.

1914. Lincoln Beachey's ACROBATICS—looping and upside downs—opening the peepul's mouths. FIRST AMERICAN AIR LINE established between Tampa-St. Petersburg, Fla., by pilot Tony Jannus and Benoist flying boats.

Passengers and express carried on schedule for some months. On Jan. 13 U. S. Circuit Court of Appeals rendered final decision favorable to the Wright company, ending 5 years of litigation of the WRIGHT-CURTISS infringement suit.

1915. On Jan. 16 Lt. B. Q. Jones made new DURATION RECORD of 8:53:00 in Martin tractor at San Diego. Being considered in Congress was bill to establish the N.A.C.A. to supervise and direct scientific study of flight.

1916. Curtiss Aeroplane Co. and Curtiss Motor Co. combined as the Curtiss Aeroplane & Motor Co. with a capital of $9,000,000. The 1915 business was reported at $5,000,000 with contracts on hand amounting to $13-15,000,000 including foreign orders for 1050 planes.

On the 19th A. M. Herring sued Curtiss and associates for a beggarly $5,000,000 on the claim he furnished the plans and ideas of the Curtiss airplane. On the 12th Floyd Smith and passenger made WORLD HEIGHT RECORD for 2 men, 12,372 feet, in delivering a Martin seaplane to the Government.

END

FLY THIS WINTER
IN WARMTH AND COMFORT
Last winter American had a 26.6% passenger increase. This winter American has prepared for an even greater increase with its new Giant FLAGSHIPS. Fly "First-Class"; Overnight, Coast-to-Coast; New York-Los Angeles, in Flagship Sleeper Planes.
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Christmas Surprise!

Nine (9) Brand New C-D Models that will make swell gifts

The New SEVERSKY FIGHTER

This unusually bulky, but unbelievably beautiful plane, has just been ordered by the U. S. Army in a large quantity because of its high speed superperformance. Span 24", beautifully colored, blue fuselage, yellow wings and tail. Very nicely trimmed with red stripe and white outline. Landing gear may be extended or retracted for display in any position. Super complete in every way. Kit SF-61, postfree, only..... $3.25

CAUDRON RACER

1936 Thompson Trophy Winner

Beautiful ¾" model of the dashing all-blue French racing plane. Span 16⅝", length 17⅝". A whiz for high-speed flights. Just the thing for Christmas. Super complete Kit SF-63, postfree, only $2.50

20" (REP) FAIREY "BATTLE" MONOPLANE

A thousand of these prototypes are being made for England's Fighting and Bombing Fleet. Rep Model is sleek and fast—yet has splendid duration qualities. Suggested coloring: All silver. Kit R-67, complete (except liquids), postfree, only.... 50c

20" REP STINSON "RELIANT"

Beautiful taper wing design model. Extremely graceful in flight and very stable. Suggested coloring: cream and green. Kit R-66, complete (except liquids), postfree, only..... 50c

These Are Now Ready, Too!

Kit D-63: ½" Caudron ('36 T.Tr. Winner). Complete but no liquids, 50c.
Kit D-55: ½" Douglas Transport. Complete but no liquids, $2.95.
Kit D-65: ½" Lockheed "Electra." Complete but no liquids, $2.25.
Kit D-61: ½" Seversky Fighter. Complete but no liquids, 95c.

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Shows over 100 C-D flying models. Also solid models, gas models, gas engines, ships, trains, etc., etc. We're being deluged with requests. Supply limited. Send 10c today for your copy—don't wait.

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DEALERS: Big Xmas sales ahead. Write!

CLEVELAND MODEL & SUPPLY CO, INC.

1866PA West 57th St., Cleveland, Ohio, U. S. A.

Sheet Metal

(*Continued from page 34*)

driven in the squeeze riveter. An examination of the blue print discloses two pieces forming the assembly.

The main piece is formed into a right angle with what is called legs, each 3 in. long. This angle is stiffened by a shorter piece with 45-degree formed ends. A strip one in. wide x 9 in. long should provide enough material for both parts. Shear one long side and square up one end.

In laying out the work, remember to provide bend allowance. Certain hard materials, such as the specification aircraft steels and heat-treated dural, stretch somewhat when being worked severely around a small radius by either a folding brake or bend block. Stretch depends upon thickness of material, radius and number of degrees of bend. The bend allowance can now be calculated.

$$BA = (.00555\,T + .01745\,R) \times N$$

where:

T = thickness of material.
R = inside radius of bend.
N = angle of bend, from flat piece to finished fitting.

Lay out all dimensions, including the bend allowance. Next, lay out the bend allowances necessary for the reinforcing piece. Here it is found that bend allowance must be made for each of the two 45 degree bends.

The bend allowance requirements for the smaller piece presents an entirely different problem to that of the larger for the accuracy of the entire assembly depends on the careful calculation of the amount of material that must be left "in the clear" on the smaller piece. In other words, the bends on the smaller piece are on the end, whereas the single bend on the larger piece is in the middle. This difference must be noted carefully.

It is assumed that a careful check with the use of a protractor square on the larger piece will reveal that enough material has been left to allow filing accurately to a finished three-in. dimension for each length. The protractor square would also reveal that an accurate right-angle bend has been made.

Reset protractor square to 45 degree and check the smaller piece for angle of bend and length of each leg. Great care must be exercised in this last check to make sure that the reinforcing piece is of the correct length.

The measurements of the four holes must be made from the back face of each leg. The simplest way of doing this is to again resort to the use of the protractor square set for 90 degrees and to measure away from the head. Lay out rivet holes in pencil, center-punch and check center punch holes carefully. Drill all holes.

The next step, obviously, is to clamp the smaller piece in place with the use of two "C" clamps and to carefully check for all dimensions before proceeding. Make sure that the "C" clamps are so placed that they will allow drilling one hole in each leg.

Carefully drill the two holes mentioned above. Insert in each hole a P. K. of the proper size. Tighten snugly. Remove "C" clamps, drill remaining holes and rivet immediately. Recheck for dimensions to make sure that assembly has not "crept." Remove P.K.'s and complete riveting. In riveting the pressure plus the expansion of the rivets, tends to increase the effective length of the sheet, causing "creeping."

By completing these three projects, you can demonstrate to yourself in a short time what native abilities and training you possess or do not possess. By learning these three projects, you can become skilled in the fundamentals of working dural, without which no aircraft mechanic can be considered proficient in his work.

END

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NEW CURTISS F11C4 NAVY PURSUIT

28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD
A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3⅜" celluloid, 1000 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.
Construction Set complete, postpaid **$4.50**

41" LOCKHEED ARMY SPEED VEGA

41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 26' rubber, 3 oz. yellow dope, 2 oz. blue, ½ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts.
Construction Set complete, postpaid **$4.95**

NEW BOEING P26A ARMY FIGHTER

22" Span. Length 17½". Weight 2½ oz. ¾" Scale

Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 3" celluloid motor, 3¼" spun tapered aluminum cowl ring, 8" steel type paulownia wood prop, 1⅝" celluloid wheels, tail wheel, insignia, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.
Construction Set in labeled box, postpaid **$2.75**

82" NEW LOCKHEED ARMY SPEED VEGA

Gas Model—Easy to Build—All Parts Ready Cut Out

82" Span. Length 54½". 2" Scale. Weight 5 lbs. with motor.
World's finest equipped and most perfect scale gas model

This is an exact scale model of the latest Army Vega, beautifully streamlined. A special de luxe flying gas model with all formers, wing ribs, tips, wheel pants already cut out and notched. Turned balsa motor front, 4½" pneumatic air wheels, silk covering, army blue and yellow dope, glue, etc. Model has removable wing, and is especially designed for gas motor. It is very strong, practically crashproof —there being no exterior parts or struts to break. Takes off in 30 foot run, flies over 1 mile on ¼ oz. of gasoline.
Construction Set complete without motor, postpaid **$25.00**

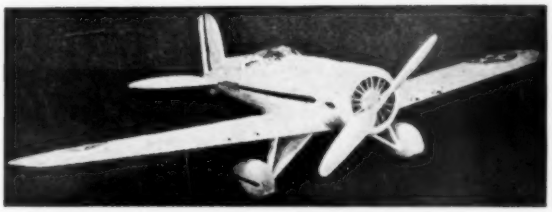
1937 CATALOG Send 3c stamp for 8"x10" beautifully illustrated Catalog containing large photos of the world's finest scale models.

Note: In issuing money orders, use St. George, N. Y., postoffice

NOTE THE VALUE. Our models are only ones on market equipped with steel type carved propellers, celluloid or aluminum cowl, celluloid motor, and aluminum push rods, etc. No other models equal them for flight or appearance. Build one and be convinced!

N E W

NEW LOCKHEED P23A NAVY FIGHTER

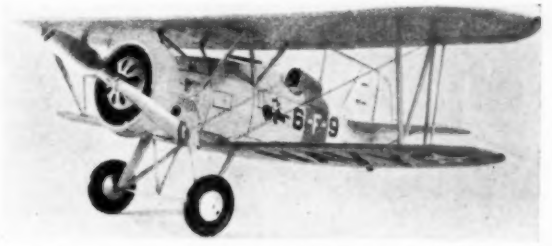


COMBINATION LAND AND SEA PLANE SET
32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅝" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.
Construction Set in labeled gift box, postpaid **$2.95**

NEW BOEING F4B4 NAVY FIGHTER

New Improved Detailed Model



22½" Span. Length 14½". Weight 2½ oz. Color, Grey, etc.

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished steel type propeller, printed out balsa wood parts, 2 oz. grey dope, ½ oz. yellow, ½ oz. red, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set complete, postpaid** **$2.95**

NEW NORTHROP FT1 NAVY FIGHTER

22" Span. Length 15". Weight 2½ oz. ¾" Scale

A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 3" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown.
Construction Set complete, postpaid **$2.00**

LOCKHEED R20-1 NAVY ATTACK

27½" Span. Weight 3½ oz. Color, Silver, etc. ½" Scale

Model is fully detailed with authentic wing rib and body stringer spacing. Every air-minded boy will want this powerful-looking model. Motor power is run through the fuselage and is concealed—a special exclusive feature.

Set contains 2 standard steel type carved wood propellers, 16' rubber, star and rudder insignia, all parts printed on balsa, 2 turned balsa motor fronts, balsa air wheels, silver dope, black, glue, full size scale drawing, and all parts to build. **Construction Set complete, postpaid** **$2.95**

California Dealer: JAYS MODEL AIRCRAFT, 7763 Melrose Ave., Hollywood, California

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

Patrol Planes

(*Continued from page* 15)

twin-engine monoplane quietly broke two world's records in a non-stop flight from Coco Solo, Canal Zone, to San Francisco.

Brilliantly this news burst upon the Navy Department! A new era in patrol boat construction was definitely under way. Sixty of these planes, which feature retractable wing tip floats, were ordered and an option on a much larger number was awarded to the Consolidated Aircraft Corporation of San Diego, California.

The huge Douglas XP3D-1 met with an immediate success while undergoing tests for the Navy Department and a large order is expected in the near future. And still the gentlemen, good and true, of the Naval Aircraft Factory, snoozed on!

Admiral Hepburn, seeing these promising developments under way, resolved that herein lay the future of the Pacific frontier defense. He has expressed himself in favor of all advances in this field and is definitely aiding the building of a huge flying boat section of the U. S. Navy.

Obviously, then, within the year, we shall see the completion of the first section of these flying dreadnaughts. With an armada of 60 or more of these tremendously powerful craft cruising about our coasts, turrets bristling with guns, bomb bays ready to release five tons of death dealing capsules, the populace of these United States can confirm a sincere emotion of security which has been wont to rise in its breast during these troubled days when the rest of the world is at each other's throats.

END

Trees

(*Continued from page* 38)

for the trees until they could get started. So the work was on.

Public school grounds were found large enough to permit a name two hundred yards in length with fifty yard letters. The trees were planted ten yards apart in the letters. The word LEXA should be seen from a height considerably above the height that planes have flown over the school building in the past, which is of advantage in clear weather as well as in bad.

First part of the work has been accomplished. It now remains for the people of the town and the school youngsters to take care of the trees until they can get started to growing when, it is hoped, they may put discomfited flyers back on their route.

END

Wing Sections

(*Continued from page* 45)

Having decided on the area and the total weight of the model we may compare wing sections as to their adaptability to our specific design: glider, microfilm, paper covered, or gasoline driven models.

In our accompanying chart we have plotted various sections: curved plates for single covered wings, thin sections for double covered ones, and thicker sections for gasoline driven models. The lift of the sections is indicated on a vertical line and the drag on a horizontal line, with the additional drag of the model (minus wing) denoted as the design factor; this design factor is equal to the ratio of the wing area and the equivalent flat plate area of the parasite drag (fuselage, tail area, etc.).

For estimating purposes we propose a design factor of 50 for gliders, 30 for stick models, and 20 for fuselage models. These values should be changed to suit the individual design, as above ratios are arbitrary.

We have developed two formulas based on a 50 percent. propeller efficiency and a 20 percent. additional power for maneuvering, which we use to estimate the required power. One formula gives you the result in H.P. and the other in ounces of rubber required per second. The weight-of-rubber-per-second is based on the test results that one ounce of rubber delivers 35,000 in.oz. of energy. Therefore, dividing the total weight of the rubber carried by the weight of rubber required we get the duration of flight in seconds. One example worked out on the chart shows you how to get the duration of a rubber driven model.

The power required depends on the power factor which is indicated by a line drawn from the design factor to the wing-section curves; the steeper the line the less power is required; therefore the tangent to the curve indicates the minimum power. To find the numerical value of the tangent we draw a parallel line through the point A and read the power factor on the scale.

Investigating the characteristics of the airfoils for minimum power we find the single thickness airfoils inferior to the streamlined-thickness airfoils, using the same weight and area; we find that for more streamlined models a lower cambered wing gives greater efficiency.

END

COLT 45 Cal.
"FRONTIER" MODEL $1.45

Basswood construction kit with working plans, machined barrel, cylinder and all necessary hardware.

COLT 45 Cal. "FRONTIER" model kit, 4¾" barrel	$1.45
COLT 45 Cal. "FRONTIER" model kit, 5½" barrel	1.55
COLT 45 Cal. "FRONTIER" model kit, 7" barrel	1.70
COLT 45 Cal. Automatic Pistol kit	1.00
Half scale Thompson Sub Machine Gun model kit	1.00
Full scale Thompson Sub Machine Gun model kit	3.00
SAVAGE Cal. 32 Auto. Pistol kit, machined barrel	.75
LUGER Auto. Pistol with 4" machined barrel	1.75
LUGER Auto. Pistol with 6" machined barrel	1.90
COLT 25 Cal. Automatic Pistol kit	.50

These beautiful kits are complete in every detail and made of the best basswood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.

GUN MODEL CO.
Dept. K-21, 2908 N. Nordica Ave. Chicago, Ill.

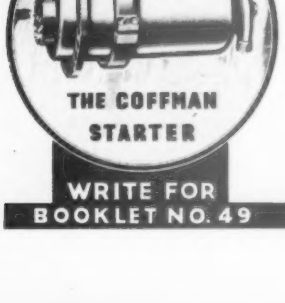
BUNCH presents the MIGHTY MIDGET

Now you can build your own gas motor for $9.85 Post Paid

Not a toy—a high-priced, precision-fitted motor—sold in kit form—accurately fitted for highest compression—made of finest materials—complete instructions with every kit — easy to assemble—develops tremendous power—speed range 500 to 7500 R.P.M.—with design propeller. Specifications: Flying weight, complete with batteries, 18 ozs. Bore 13/16". Stroke 13/16". Steel cylinder, bolted-type aluminum head. Save Money. Order Today.

Mighty Midget, Assembled . . $17.50 Post Paid
Mighty Midget, Kit . . . . . 9.85 Post Paid

BUNCH MODEL AIRPLANE CO.
5009 SOUTH HOOVER ST., LOS ANGELES, CALIF.



WRITE FOR BOOKLET NO. 49

DEPENDABLE POWER FOR STARTING YOUR AIRPLANE ENGINE

Zero weather calls for a Coffman Starter. With fluid pressure smoothness, it will turn your engine with starting speed at sub-zero temperatures. It will put no drain on battery.

If you have more than one engine, try a Coffman Starter this winter for comparative tests, and see the remarkable difference.

Six important features—1. Simplicity of operation; 2. Less priming; 3. More power and smoothly applied; 4. Self lubricating; 5. No booster magneto; 6. Low maintenance cost; 7. The lightest weight airplane starter for its developed torque. Built for engines of 200 H. P. up to 1250 H. P.

FEDERAL LABORATORIES, INC.
185 41st STREET • PITTSBURGH, PA.

Airy Chat

(*Continued from page* 12)

There were many garage mechanics and automobile service station operators, many college students and a great number of aviation executives and flight instructors. According to the librarians that answered, and we have many libraries on our circulation list, the copies of P.A. in their libraries are being overworked.

* * *

AT THIS point I wish to make a blanket reply to the many letters beginning, "why don't the engine builders produce a Diesel aviation engine to take the place of the present carbureting type gasoline engines?"

For their information I will say that a number of Diesel type aviation engines have been developed in the United States and have been thoroughly tried out by the airlines—but none of them have proved satisfactory so far. They show very little improvement over a high grade well designed gasoline aviation engine so far as fuel economy goes, and they are far from being as reliable. The increased cost of Diesel maintenance more than overshadows the saving in gas.

* * *

ONCE upon a time, in the dim distant past, it was possible for a poor boy to enter the aviation industry via the apprenticeship route, but this entry is now practically a thing of the past.

The requirements of the Bureau of Air Commerce are exceedingly rigid in respect to aviation students and make it compulsory for these boys to study and graduate from an approved aviation school.

They must not only pass a flying test but also a mental test and a written examination that requires attendance at a good ground school imperative.

* * *

WE FEEL a great sympathy for the enthusiastic boys whose whole ambition is to become a pilot or designer, but we have found that there is no substitute for money in the study of aviation. The only method, but also the best method, is to work hard, save up your pennies and endure your present occupation until such a time that you have saved enough money for taking a course.

* * *

SEVERAL new lightplane projects are now on the way and it looks as if a good little ship can be obtained at a reasonable price by next summer. This is not the first time that this prediction has been made in these columns, not by a long shot, but we hope that the project will finally work out during the coming summer. I have been hoping for this to happen since 1909 but so far, no luck.

* * *

ABOUT every so often, some one comes bolting into this office, all out of breath and with his eyes bulging out to tell us that Henry Ford is already to go into production on a flivver lightplane. Last month, these glad tidings arrived twice by two different persons but still we won't believe it. Ford may be playing around experimentally but he is still a long way from the production stage so far as we know at present.

* * *

And so, we conclude the last Airy Chat for 1936 and the first for 1937, bumping into the adverts as usual. So long—see you next month. J. B. R.

Gates Circus

(*Continued from page* 40)

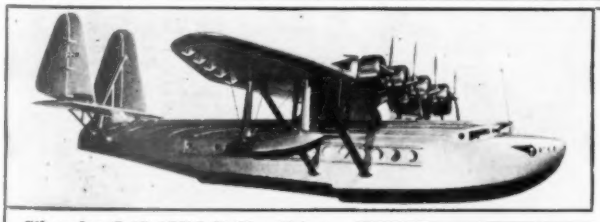
with the geese, with his brother for company.

One bright, sunny day, the two brothers were throwing firework bombs out of their Waco over Macon, Georgia, advertising a local American Legion Post air meet. His young brother would hand him a bomb; Bucky would pull the fuse and throw it overboard, where it would explode a few hundred feet below, scaring everybody around for miles into rushing for their shotguns preparatory to a Yankee siege, thinking the Civil War was still going on.

They had good reason to fear. For in happily tossing bombs over the side, Bucky made his last mistake. He dropped one of the bombs on the floor of his ship just after pulling the fuse. Frantically reaching for the live bomb, Bucky was just in the act of heaving it overboard when the deadly explosive burst, decapitating Bucky then and there.

The ship was bent in half by the force of the explosion and the two brothers, one headless, the other unhurt but wild with terror, plunged earthward. The ship hit squarely in the center of the main thoroughfare at Macon, killing two pedestrians in its short reign of terror, and Bucky's younger brother. And so another great flyer took his final bow to the clouds he had dared for so long.

END



D. E. L. Solid Scale Models

Sikorsky Clipper

S-42 Span 34¼"

Kit is furnished with new features as follows: metal cast motors; cowls; and pilot cabin, cowls are machine finished.

Complete Kit **$6.75**

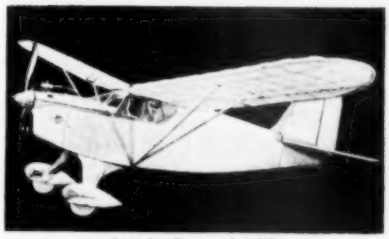
Sikorsky S-42 17¾" $1.75. China Clipper 16¼" $1.50. Martin Bomber 17¾" $1.75. Boeing 247 Transport 13¾" $1.25. Hell Diver 12" $1.25. Spad XII 12" $1.50. Fokker D VII 12" $1.00.

Each Kit contains everything required to make a perfect and complete (Balsa) Model. Kits are sent prepaid and insured. Send 3c stamp for illustrated folder. Remit cash or Money Order. No Stamps. No C.O.D.

D.E.L. AERO MODEL WORKS, Dept. B, 1016 N. Front St., Philadelphia, Pa.

Complete Kit for 64 in. Scale Model

REARWIN SPEEDSTER



Can be Powered with Gas, "IMP," Air or Rubber Motor

Specially Designed by **JOE OTT.** 64 in. Wing Span. Weight 18½ oz. Gliding Ratio—6 to 1. Adjustable Angle of Incidence. Wings Removable for Carrying.

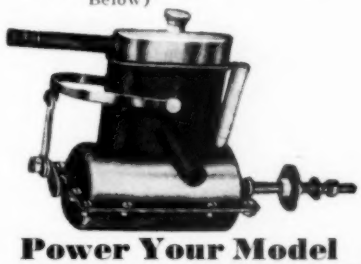
Big Value Kit with Many Special Fittings

This Kit is complete with every item required, including Cork-Aluminum Balloon Tire Wheels, 12 in. Mahogany-finished "IMP" Propeller, fully finished, "IMP" Propeller Shaft, Cork-Aluminum Skid Wheel, Soft, Medium and Hard Balsa Wood, fully shaped Wheel Cowlings, Wire, Cement, Celluloid, covering Paper and everything else, including Complete Plan in Full Size with Details in Accurate Scale.

Complete Kit only $5.00

(Plus 25c Postage)

(See Special Offer Below)



Power Your Model with the IMP S-2 TORNADO MOTOR

Easily installed in the REARWIN SPEEDSTER, or other type Model. The simplest, safest most reliable and lowest cost power unit for any Model. Starts instantly; runs on AC:CO Gas, generated in the "IMP" Generator; safe, economical, powerful. Will also run on compressed air.

Model S-2 "IMP" Tornado Motor; 2 Cylinder. Weight 2½ oz. Flies Models 3 to 6 ft. size. Complete with Generator, Feed Line and Safety Clip **$5.00**

(Plus 25c Postage)

Special Combination Offer

REARWIN SPEEDSTER Kit with "IMP" S-2 Motor, postpaid for $10.00

Canada and Foreign Prices:

Kit Complete .....$ 5.50
Motor Complete 5.50
Kit and Motor Complete..... 11.00

Send 3c for New Catalog Guide listing Lowest Prices for "IMP" Model Airplane and Boat Accessories.

International Models Company

Motor Division

251 West 55th Street, New York, N. Y.

British Agents for "IMP" Products:
Model Airplane Stores, 42 Derby Road, Prestwich, Lancs.
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M & M GAS WHEELS

Size 3¼" Price $1.25 Per Pr.—P. P. For Air Mail Add 21c

Designed for Light Weight Gas Models.
See M & M's Latest —Snappy Super-Wheels at your dealer—He Has Them
All M & M's can be inflated and deflated

M & M's FOR RUBBER POWERED MODELS

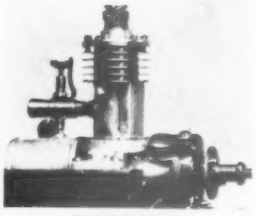
SIZES 1¼—1⅜—1½—1⅝"—PRICE $0.50 Per Pair Postpaid.
SIZES 1¾—1⅞—2—2⅛—2¼—2⅜—2½—2⅝"—PRICE $0.60 PER PAIR POSTPAID.
OBTAIN: M & M WHEELS from any leading dealer, or send direct to the factory. FOR AIR MAIL ADD 11c on small sizes.

Obtain M&M's from your dealer or send to us
Dealers: Our New Discounts Are Very Attractive
FANS: Send For FREE literature showing full-size wheels

M & M MODEL WHEEL CO.
325 North 79th Street. Dept. P-12. Seattle, Wash.

1/6 H. P. MODEL GAS MOTOR

N E W N E W



WHIRLWIND
For 5 to 7 Foot Models

A very sturdy easy starting precision made motor specially counter-balanced for model planes or boats.

Steel cylinder.
Bore ¾ inch.
Stroke ¾ inch.
H. P. 1/6 at 4,000 R. P. M.
Weight 8 ounces.
Height 3½ inches.

Price, Ready to Run.....$21.00
Boat Type Water Cooled..... 25.00

Catalog—5c coin.

MINIATURE AIRCRAFT CORP.
83 LOW TERRACE, NEW BRIGHTON, N. Y.

BIG HOLIDAY GIFT!

On all orders for $1.00 or over received before January 10, we will send you absolutely

FREE!!
a SURPRISE GIFT
worth 75c

This cancels all previous free offers, only when using this ad.

To entitle you to this extraordinary gift, your order must be received not later than January 10, and must be accompanied by this ad.

This is our way of thanking you for the marvelous business we have enjoyed in 1936. Quality, value, and service have made Imperial the buyword for model kits and supplies.

For Imperial prices, refer to our ad in any previous issue of this magazine, or send for free price list

IMPERIAL MODEL AERO SUPPLY
416A McDONALD AVE. BROOKLYN, N. Y.

Engines

(*Continued from page* 28)

resistant to deterioration at high temperatures and to the action of lead compounds in combustion.

Pistons are forged from aluminum alloy, cross ribbed on the under side of the head to provide greater strength. These cross ribs also tend to conduct heat away from the head to the skirt of the piston, where it is dissipated through the cylinder barrel wall to the cooling fins. Oil spray striking the cross ribs likewise aids in cooling. The skirt of the piston is slightly longer than on previous Cyclones to provide improved bearing surface and eliminate any tendency of the piston to "rock" in the cylinder.

The connecting rods of the "G" Cyclone are of forged alloy steel. The assembly consists of a one-piece master rod and eight articulated rods. Greater strength and stiffness has been provided in the master rod used with the "G" Cyclone through refinements introduced to equalize stresses at the increased power output.

Knuckle-pins have been increased in wall thickness and a tighter fit in the master rod flange provided. Improved seating surfaces for the pins have been obtained by providing a mirror-finish in the knuckle-pin holes. The crankpin hole of the master rod is also polished to provide a perfect bearing surface between the rod and the steel shell of the high lead bronze crankpin bearing.

The crankshaft of the "G" Cyclone is identical in general form and dimensions to that of the previous "F" Cyclone with minor incidental modifications in certain detailed dimensions. It is of the single throw type, constructed from two forgings of chrome nickel steel clamped rigidly together at the rear crankcheek, and supported on three bearings.

Aside from the proved reliability and simplicity of the type of construction, the most noteworthy feature of the "G" Series Cyclone crankshaft is the dynamic damper —an exclusive Wright development—attached to the rear crankcheek in place of the conventional rigidly mounted counterweight. First introduced in the "F-50" Cyclone Series and later adapted to many "F" Cyclones at the demand of operators cognizant of its great service value, this device has already proved itself in more than a quarter million hours of arduous flying operation.

Torsional vibration present in some measure in all conventional aircraft engines and destructive critical torsional periods present in all rigid crankshaft systems have been completely eliminated in the Cyclone crankshaft by the introduction of the dynamic damper. This device imparts to the Cyclone a smoothness of operation unapproached by any comparable aircraft engine of similar power output. It effectively counteracts torsional vibration at all crankshaft speeds, removing any restrictions in the operating range imposed by consideration of vibration characteristics.

The general appearance of the dynamic damper, as may be seen from the illustration, does not differ greatly from the conventional counterweight. It is extremely simple and rugged in construction. It is entirely self-contained and introduces no complications that can in any way adversely affect engine operation.

It is, in principle, a pendulum counterweight which is mounted on the crankshaft in place of the conventional rigidly mounted counterweight; the pendulous mass being free to oscillate in a restricted arc relative to the counterweight and in the plane of rotation of the counterweight. When disturbed, the restoring force and the frequency of a given pendulum so mounted is determined by the acceleration due to the centrifugal force of rotation of the counterweight.

The magnitude of the acceleration is in turn determined by the speed of the rotation of the crankshaft. Hence, the frequency of any given pendulous mass so mounted will bear a fixed ratio to the speed of rotation of the crankshaft. In the case of the Cyclone engine the mass and dimensions of the pendulous weight are of such values that the natural period of oscillation is four and one-half times crankshaft speed, which equals the frequency of explosion impulses.

In operation the pendulous weight is of such dimensions and so mounted that it oscillates at explosion frequency but out of phase with the explosion impulses, and thus applies a counter torque to the crankshaft which balances out the periodic torque fluctuations arising from the explosion impulses, which explosion impulses cause tortional vibration in any conventional rigid crankshaft system.

Stops are provided to limit the motion of the counterweight during acceleration or deceleration of engine r.p.m. These stops are so arranged that they permit a motion considerably in excess of that required to completely damp the torsional vibration at any speed. During normal

AERONAUTICAL ENGINEERING
DEGREE IN 2 YEARS

Become an Aeronautical Engineer. Tri-State College course given in 108 Weeks. Bachelor of Science degree. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Thorough training in all fundamental engineering subjects. Equipped with wind-tunnel (see illustration). Non-essentials eliminated. Courses designed to save student time and money. Flying school facilities available at nearby airports. Properly trained engineers in design, research, manufacture and sales work are in demand. Enter September, January, March, June. Courses are offered also in Civil, Electrical, Mechanical, Chemical, Radio Engineering; Business Administration and Accounting. Living costs and tuition low. Those who lack high school may make up work. World famous for technical 2-year courses. Graduates successful. Write for catalog.

717 COLLEGE AVE., ANGOLA, IND.

TRI-STATE COLLEGE

steady operation, therefore, the counterweight never strikes the stops.

The dynamic damper as applied to the Series "G" Cyclone should not be confused with conventional friction dampers. Its action is entirely different and more effective, because the action of a friction damper is confined to the dissipation (by friction) of some of the energy of the vibration, and therefore its actual restraining action on the vibration is limited.

The dynamic damper, on the other hand, is virtually frictionless and dissipates essentially no energy by friction. It acts by introducing a balancing force which is opposite in direction and equal in magnitude to the disturbing force at all speeds. By reason of this action, the dynamic damper has the potential ability to reduce crankshaft torsional vibration to zero. No other type of damper has achieved these results.

Valves are actuated by a cam housed in the nose section of the crankcase. Hardened steel cam follower rollers, running on the cam ring, operate the rocker arms through fully enclosed push rods of seamless steel tubing. The rocker arms are carried on special Timken tapered roller bearings mounted in the enclosed boxes on the cylinder head.

The Wright Cyclone may be provided either with or without propeller reduction gears. Geared engines have a propeller speed reduction unit, encased in the nose section, of 16 to 11 ratio. Consisting entirely of spur gears, the Wright 16 to 11 gear unit is exceptionally compact and light in weight. Its reliability has been proven in thousands of hours of airline and military operation.

Positive dual ignition is provided by two Scintilla Aircraft Magnetos operating two independent sets of spark plugs. The entire ignition system, including magnetos, wires and spark plugs, is completely shielded for radio interference. Both magnetos and spark plugs have been materially improved from the standpoint of operation and accessibility, as the result of service experience and extensive research. A new type of breaker mechanism and magnet provide a hotter spark and improved operation at high altitude.

All parts of the Cyclone, including the valve gear, are lubricated from the main oil supply. Full pressure lubrication is provided to all of the main bearings by a gear type pump. A cuno oil strainer thoroughly cleans all incoming oil. An adjustable relief valve automatically maintains a uniform oil pressure in the system and bypasses excess oil to the inlet line, thus easing the duty required of the oil cooler. The oil from all parts of the engine drains to a sump between the bottom cylinders and is scavenged by a gear type pump.

The use of a short tube to lead the lubricating oil from the center of the crankpin chamber to the master rod bearing converts the crankpin chamber into a centrifuge which removes from the lubricant particles too small to be separated by the oil filter. This crankpin centrifuge is an exclusive Wright development in the aircraft engine field. It is made possible by the design of the Wright Cyclone crankshaft.

Especial care has been given to the elimination of oil leaks, to make the "G" Cyclone the cleanest running aircraft engine in production. The distinctive Wright piston ring type of oil seal has been applied to the supercharger drive shaft, the propeller thrust nut, the propeller shaft oil transfer sleeve for the hydro-controllable propeller, and the cam drive gear oiling bracket.

All oil leakage into accessories has been eliminated in the Wright Cyclone by the use of special oil sealing bushings on the accessory shafts. These consist of Oilite bushings on the generator drive, tachometer drives, angle type and spur gear type vacuum pump drives, and the drive for the constant speed propeller governor.

Oil, under pressure, is led to the exterior of the bushings and is fed through the bushings to the shafts by capillary action.

END

Jokes

(*Continued from page 24*)

never heard a complaint. What does that prove?

Voice from Rear: Dead men tell no tales!

* * *

Capt.: The blimp is falling. Is there anyone here who knows how to pray?

Man: Yes, sir; I do.

Capt.: Okay, you pray—the rest of us will put on the parachutes. We're one shute shy!

* * *

Stewardess: The man who kissed me in the cockpit isn't the man I thought he was.

"How do you know?"

Stewardess: The man I thought he was just punched him in the nose!

* * *

Passenger on Plane: Is Newark airport the next stop?

Porter: Yes, sir. Shall I brush you off?

Pass.: No, I'll get off myself!

END

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How to Fly

(*Continued from page 30*)

conditions. Perhaps the best way to illustrate this point is to give an example of such a difficulty.

Let's suppose a bounce occurs just before the wheels leave the ground and the ship tilts over sideways, dropping the left wing. The natural thing to do is to push the stick over to the right to bring the wing up. But as soon as this is done, the drag of the low aileron makes the ship swing to the left.

To correct this tendency, you would naturally expect to apply right rudder. However, that may be easier said than done if the propeller turns clockwise when viewed from behind, which is usually the case except with some motorcycle engine conversions. The propeller torque, and the slipstream striking the left side of the rudder, makes the ship try to circle to the left.

This effect is more pronounced when running along the ground than when flying, and becomes stronger as speed is gathered before taking off. To correct this tendency, you have applied right rudder, perhaps nearly as far as it will go. Then, you have no margin of control left to counteract the drag of the aileron on the left wing.

All this will happen within a few seconds at the most, so you won't have much time to figure things out.

The safest way of handling the above situation, in fact about the only logical way, is to let the wing stay down and take off on one wheel in a slow turn to the left, the ship already being banked in that direction.

The gyrostatic forces caused by the motor will tend to make the ship nose down in a left turn, so there will be little danger of stalling on such a turn. As soon as enough speed has been gained to minimize the dragging tendency of the ailerons, the wing can be brought up and the ship put into a normal climb.

It might be interesting at this point to note that most parasol type lightplanes when flying at full throttle with the elevators neutral will assume the proper climbing angle of their own accord, due to the action of the thrust well below the center of lift.

Under normal conditions, climbing turns should be avoided like poison, but in some cases they may be necessary, as when an obstacle has to be cleared in taking off. Even then, it should not be continued any longer than absolutely essential.

A stall during a climbing turn is much more liable to occur, and when it does it is more dangerous because, in trying to regain control, the inexperienced pilot usually does the very thing he should avoid doing.

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As the stall approaches, he will kick the rudder over violently in a vain attempt to straighten out of the turn. This, or any other sharp movement of the controls, promptly stalls the ship hopelessly, and down she goes in a nice dive or side-slip.

Another danger in turning close to the ground lies in the fact that the pilot may give the ship too much rudder, which of course causes a skid. The flying speed is lost quickly and the nose begins to settle alarmingly. Fearing that the ship will dive into the ground, the pilot pulls the stick back in an effort to straighten out. The ship promptly slips into a spin from which there is no chance of recovery.

If you feel a stall approaching under such conditions as outlined above, the proper thing to do is to let the ship continue in the turn, easing the nose down cautiously until control is regained. The ability to handle emergencies such as this, doing the right thing at the right moment, is what determines whether one is a good pilot or a poor one.

I have already covered the landing of a lightplane in a past issue of POPULAR AVIATION, so it will not be necessary to go into detail on that subject here.

The handling of light seaplanes has not been given much attention in the past, but since this type of ship is becoming increasingly popular, a few hints regarding the subject may be of interest. A pair of well-designed floats, properly installed, will not affect the performance or flight characteristics of a lightplane to any noticeable extent. The only time they affect the handling of the ship is during take-offs and landings.

END

Private Flying

(*Continued from page* 20)

pitched on my college's soft ball team, I was noted for my control.

Arizona? So soon? Now be careful how you land, John. That's the sign of a skillful flyer, if he lands right, but somehow I have doubts about your skill in that department. You're so abrupt about everything.

Well, show me then by doing it. I only wanted to warn you to be careful. Oh, oh! hang on to mother, Bobby! Daddy's going to crash! There, I knew it! Thank Heavens, though, we're safe, even if one wheel is smashed! Tombstone! How nearly appropriate that name is, sonny, when your father tries to land a plane.

END

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Rhys-Davids

(*Continued from page* 18)

victories. At this time his famous color scheme became well known. It was first used on his Albatross and later on the Fokker triplane which he flew. The coloring consisted of a checkered fuselage, black and white, with a skull and crossbone insignia on each side, red wings and red tail. From this decorativeness he gained the title, "The Checkerboard Ace." He was noted for his two most used maneuvers, the barrelroll and sideslip.

In September, 1917, he won ten victories in ten days, thus bringing his total victories to forty-eight. In September he was wounded in the right arm, but not seriously.

While inactive, due to his wound, he had a captured British rotary engine installed in his famous checkered Fokker triplane. This was not entirely satisfactory. On the twenty-third of September he was forced to use another Fokker triplane, as his own was having its engine overhauled. And on the twenty-third of September, 1917, Lieutenant Werner Voss fell to his death.

On the evening of September 23, 1917, "B" Flight took off and crossed the lines at Bixchoote at 8,000 feet, for there was a thick wall of clouds extending up to 9,000 feet. They flew south from Houthoulst Forest, and when over Gheluvelt the flight dove upon a Hun two-seater biplane, a D.F.W., which they sent down out of control. There was an unusual amount of enemy activity, and there were many different type machines up. They then flew north at an altitude of 6,000 feet.

All about them were many formations of allied machines—Sopwith Camels, Sopwith Pups, Bristol Fighters, R. E. 8s, Spads and S. E. 5s. They were about to engage in combat with six Albatross scouts, to their right, when they saw ahead of them, above Poelcappelle, a British S. E. 5 spinning away from a silvery-blue Fokker triplane which was close upon its tail. The formation dove, to the aid of the S. E. 5, upon the Fokker triplane, which was now just below them.

McCudden attacked from the right and Rhys-Davids from the left. Both arrived upon the Hun triplane's tail at the same moment. The German pilot saw them and went into a flat half-spin turn which threw their aim off. The triplane was now in the middle of the formation of S. E. 5s, all of which fired at it. The skillful control of the triplane was very evident. The Hun pilot seemed to be firing at all S. E. 5s simultaneously, so excellent was his flying. His flying was so perfect and his maneuvers so quick that no one of the British machines could hold him in the gun sight for more than a fraction of a second.

As the triplane came toward McCudden, slightly below him, he caught him in the sight and fired a burst at the Hun. As soon as McCudden had opened fire the German machine raised its nose and fired at McCudden, the bullets passing through the upper wing of the S. E. 5. McCudden could clearly see the flashes of fire from the Hun's twin Spandau machine guns. As the triplane passed below McCudden he caught a glimpse of the German pilot—a dark head without a helmet, the black hair streaming in the wind.

The formation of six Albatrosses had been unable to come to the aid of the triplane pilot, whom the British now recognized as an ace, because a formation of Spads had entered into a dogfight with them. A red nosed Albatross scout had entered the one-sided combat and was doing its best to guard the tail of the Hun triplane. The Albatross scout was undoubtedly handled by another ace, for it was flown with much skill. However, the Albatross was hit shortly after entering the fight, and it went down.

The fighting had become very low and the triplane was having difficulties. Never did Voss try to escape. He realized that he was up against the best flyers that the British had, but he showed his true courage and fought to the end. At one time there was visible the tracer bullets from five different British machines centering upon the triplane.

The triplane was now very low and was being fired upon by an S. E. 5 with the letter "I" upon the right upper wing. This was Rhys-Davids' machine. The Hun went into a flat dive; all the while Rhys-Davids was firing into the fuselage of the triplane. The control of the triplane became loose and the machine yawed from side to side.

Its dive became steeper as it screamed downward, gathering speed. At a tremendous speed it hit the ground on its left wing and literally dissolved into pieces. The wreckage slowly settled upon the broken body of its pilot, the courageous German ace, Lieutenant Werner Voss.

When the seven pilots landed at their aerodrome they were loud in their praises of the bravery of the German ace they had

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Silver or Super-fine Tissue.	5c
Doz.	50c

Thinner Best

1 oz.	5c

18" BALSA STRIPS

1/16x1/16	125 for 5c
1/16x1/8	50 for 5c
1/8x1/8	30 for 5c
1/16x3/16	25 for 5c
1/16x1/4	20 for 5c
3/32x3/32	40 for 5c
1/8x1/4	12 for 5c
1/4x1/4	10 for 5c
1/4x1/2	5 for 5c
1/2x1/2	4 for 5c

18" BALSA PLANKS

1x1, 1 for	4c
1x2, 1 for	9c
2x2, 1 for	15c
2x3, 1 for	19c
2x6, 1 for	35c

Sheet Celluloid

2x6	2c
6x8	4c
12x16	15c

Clear Dope

1 oz.	5c
1/2 pt.	25c

Colored Dope

1 oz.	5c
1/2 pt.	30c

Clear Cement

1 oz.	5c
1/2 pt.	25c
1 pt.	45c

Wood Veneer

20x30", 1 for	9c
2 for	17c

Reed

1/32, 1 16"	
	3 ft. 1c
1/8	3 for 2c

Wooden Wheels

1/2", 2 pair	3c
3/4", pair	2c
1", pair	4c
1 1/8", pair	4c
1 3/4", pair	7c

Celluloid Wheels

3/4", pair	5c
1", pair	7c
1 3/8", pair	9c
1 7/8", pair	15c

Balsa Balloon Wheels

1/2", 2 pair	3c
3/4", pair	2c
1", pair	3c
1 3/8", pair	5c
2", pair	8c
3", pair	14c

PROP. SHAFTS, 2 for 1c

PAUL-O-WINA JAP PROPS

5", 10c

(add 5c per inch for props up to 10".)

Machine Props

5", 4c

(add 1c per inch for props up to 16".)

Rubber Motors

1/16 sq. 20 ft. 5c

1/8 flat, 20 ft. 5c

INSIGNIAS— French, American, English, German 1 1/2" 4 for 3c

2" 1c

1 sheet of 24, 5c

Dummy Radial Engines

1 1/2" Diam. 14c

2" Diam. 18c

3" Diam. 23c

DOWELS, 1 6x12 10c per doz.

SPOT WELDED HOLLOW ALUMINUM WHEELS

1", pr. 6c

1 3/8", pr. 11c

1 7/8", pr. 14c

Sheet Aluminum

.003, sq. ft. 10c

Alum. Tubing

1/16", 3/16", 1/4", 10c ft.

ALUM. LEAF, 2 sheets for 1c

WIRE, 6 ft. 3c

36" lengths.

NOSE PLUGS, large, 10c doz. small, 5c doz.

Miscellaneous

Washers, 1/4, 1/8 doz. 1c

Sandpaper, pkg. 5c

Model Pins, pkg. 5c

Brushes No. 6, 5c

Thrust Bearings 1c

Bushings, doz. 3c

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Strathmoor Sta., Dept. B2, Detroit, Mich.

just vanquished. They all debated as to who the pilot was—they realized that he was one of the enemy's best. The belief was that the pilot was either Richthofen, Voss or Wolff. The next morning the squadron received the news from Wing headquarters that the dead pilot was wearing the "Ordre Pour le Merite" and the Boelcke collar, and that his papers identified him as the great ace, Werner Voss.

The brave pilot, Voss, had fought single-handed seven enemy machines piloted by aces whose total victories were well over one hundred. He had fought machines which were the equal of his, if not superior, and had put bullets through all seven of the machines attacking him. He had survived for ten minutes against these great odds—in the air where seconds count as minutes.

Rhys-Davids, himself, said, "Oh, if I could only have brought him down alive!" Rhys-Davids received many congratulations, but he remained still the unaffected boy, but the war was taking toll of him—he grew more serious. His nerves suffered and in his combats he grew more reckless. He began to follow his victims down to the ground—a sure sign of nerves.

The following day, in the evening, Rhys-Davids crashed a German two-seater near Houthoulst Forest. Four days later, on the morning of September 28, he shot down an Albatross scout over Houthoulst Forest. On the first of October, in the evening, Rhys-Davids took on four black and white Albatross scouts, but won no victory.

Over this period there was heavy fighting daily and a patrol never returned without having had several combats. On October 1 McCudden saw Rhys-Davids' S. E. 5 among the four black and white Albatross scouts, and, as he said, it could be no one else but Rhys-Davids, for if one was over the Salient in late 1917 and he saw a single British machine fighting like Hell amongst a bunch of Huns, nine times out of ten it would be Rhys-Davids.

On October 3 Rhys-Davids was awarded the Distinguished Service Order. At this time his recklessness increased and he entered into combat with greater numbers of enemy machines than was safe.

On October 11, 1917, Rhys-Davids won his last known victory. Over Menin he sent down an Albatross scout.

On October 24, 1917, Rhys-Davids, who was acting as flight-commander, took off for a patrol over the lines. He was last seen flying into the east toward a formation of German scouts. From this point Lieutenant Arthur Rhys-Davids disappeared from the eyes of man. He is another ace who disappeared, who is listed in the books as "missing."

At the time of his death he had twelve official victories, but his actual number of victories is placed nearer forty. A youth of seventeen accomplished all these feats. Rhys-Davids was truly England's boy ace.

END

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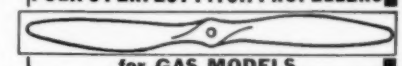

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1/32x1/16 ..... 10c
1/16x1/16 ..... 10c
1/16x3/32 ..... 18c
1/16x1/8 ..... 19c
1/16x3/16 ..... 24c
1/16x1/4 ..... 26c
1/6x1/2 ..... 60c
3/32x3/32 ..... 24c
1/8x1/8 ..... 29c
1/8x3/16 ..... 48c
1/8x1/4 ..... 52c
3/16x3/16 ..... 65c
1/4x1/4 ..... 80c
1/4x1/2 ..... $1.50
1/2x1/2 ..... 2.15

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Scale craft flyer plans with movable controls: Post-Rogers Lockheed or the Monocoupe, $1.50 per doz., or $9.00 per hundred.

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1/64x2 ....10 for 14c
1/32x2 ....10 for 14c
1/16x2 ....10 for 17c
3/32x2 ....10 for 20c
1/8x2 ....10 for 22c
3/16x2 ....10 for 31c
1/4x2 ....10 for 40c
½x2 ....10 for 75c

BALSA PLANKS 36" Lengths

1x1, each 6c
1x1½, each..... 9c
1x2, each 13c
1x3, each 20c
1x6, each 35c
1½x1½, each ...25c
2x2, each 25c
2x3, each 35c
2x4, each 45c
2x6, each 60c
3x6, each $1.25

COLORLESS CEMENT

1-oz. bots., ½ doz.23c
2-oz. bots., ½ doz.40c
4-oz. bots., ½ doz.70c
1 pt., each.....40c
1 qt., each.....70c
1 gallon, each..$1.75

CLEAR DOPE OR BANANA OIL

1-oz. bots., ½ doz.23c
2-oz. bots., ½ doz.40c
4-oz. bots., ½ doz.70c
1 pt., each.....35c
1 qt., each.....65c
1 gal., each....$1.50
Thinner same price as clear dope.

JAPANESE TISSUE

White, per doz...12c
Colored, asst., per doz. 15c
All colors.
Silver, per doz...21c

STANDARD PITCH BALSA PROPELLER BLOCKS

Per Dozen

½x3½x5 ..... 5c
½x3½x6 ..... 6c
¾x1x7 ..... 14c
¾x1x8 ..... 18c
⅞x1x9 ..... 25c
¾x1¼x10 ..... 30c
¾x1¼x12 ..... 35c
1x1½x12 ..... 40c
1x1½x15 ..... 55c

BAMBOO

1/16 sq. x 14, 1 gross for 10c
1/16x¾x11, 1 doz. for 5c

REED

1/32 or 1/16 dia., 50 ft. for.....18c
3/32 or ⅛ dia., 50 ft. for.....20c

ALUMINUM COWLING

Closed or Open

1½" dia., 3 for..25c
2" dia., 3 for 35c
2½" dia., 3 for..43c
3" dia., 3 for..55c
4" dia., 3 for..80c

FRESH PARA RUBBER AAA GRADE

Per 225' skein

1/32 sq. 25c
.045 sq. 35c
3/32 flat 35c
1/8 flat 40c
3/16 flat 70c
1 lb., any size..$1.00

DOWELS

1/16" dia. x 12", 100 for 55c
25 for 20c
⅛" dia. x 36", 100 for $1.50
25 for 45c
3/16" dia. x 36", 100 for $2.25
25 for 75c
¼" dia. x 36", 100 for $3.00
25 for 1.00

SHEET CELLULOID

(Transparent)

12½x16, each 19c
6x8, doz. 65c

INSIGNIA SHEET

12 pr. & rudder and tail markings with gummed back. Doz., 36c; 100, $1.75

DUMMY RADIAL ENGINES

(Celluloid 9 cylinders)

1½" dia., ½ doz. for 80c
2" dia., 3 for....65c
3" dia., 3 for....85c

CELLULOID MOTOR AND DRAG RING COMBINED

1½" dia., 3 for..40c
3" dia., 3 for...75c

NOSEPLUGS, HARDWOOD

1 doz. 5c
100 .....40c

CELLULOID WHEELS

⅜" dia., per doz.24c
1" dia., per doz.25c
1⅝" dia., per doz.35c
1⅞" dia., per doz.60c

BALSA BALLOON WHEELS

(Machine Turned)

¾" dia., per doz. 9c
⅞" dia., per doz.11c
1" dia., per doz.14c
1⅜" dia., per doz.19c
1⅞" dia., per doz.38c
3" dia., per doz.85c

BIRCH WHEELS LIGHT AND STRONG

½" ....per doz. 5c
⅝" ....per doz. 6c
1" ....per doz. 8c
1⅜" ....per doz. 10c
1⅞" ....per doz. 15c

BRASS BUSHINGS OR EYELETS

Per 100

1/16 diam. 12c
3/32 diam. 15c
1/8 diam. 18c

THRUST BEARINGS (Hard Steel)

Small, per dozen. 6c
Small, per gross..55c
Large, per dozen.. 7c
Large, per gross..70c

WASHERS PER 100

⅛ brass O. D.....5c
¼ copper O. D....5c

WIRE PER 100 FT.

(Straight Lengths)

No. 6.....15c
No. 8.....18c
No. 10.....20c
No. 12.....23c
No. 14.....26c

SHEET ALUMINUM

Per 5 ft.

.002 thick.....35c
.005 thick.....50c
.010 thick.....75c

ALUMINUM TUBING

(Special 1/100" wall)

1/16 O.D., 5 ft...30c
3/32 O.D., 5 ft..32c
1/8 O.D., 5 ft...32c
3/16 O.D., 5 ft..40c
1/4 O.D., 5 ft...45c

COLORED DOPE

White, yellow, orange, blue, red, green, olive, khaki, black, silver, gold or gray.

1-oz. bottles, per ½ doz. 30c
2-oz. bottles, per ½ doz. 55c
4-oz. bottles, per ½ doz. $1.00
1 pt. each.....50c
1 qt. each.....85c
1 gallon, each..$2.25

SANDPAPER

5 Pieces to the Pack
Per doz. pkgs....25c

HIGH GLOSS

To shine up colored models.

1-oz. bottles, per ½ doz.....30c
2-oz. bottles, per ½ doz.....55c
4-oz. bottles, per ½ doz.....$1.00

CELLULOID PANTS

For ⅜" or 1" wheels, ½ doz.50c
For 1⅜" or 1⅞" wheels, ½ doz.75c

¾ FINISHED BALSA WHEEL PANTS

Ready for final sanding

To fit: 6 pr.
½" wheels.....36c
⅝" wheels.....36c
¾" wheels.....36c
1" wheels.....54c
1⅜" wheels.....54c
1⅞" wheels.....54c

PROP SHAFTS (Hard Steel)

One size fits all models

Per dozen 10c
Per gross 75c

REAR HOOKS (Hard Steel)

One size fits all models

Per dozen 10c
Per gross 75c

DIE-CAST BOMBS

⅝" long, 3 for 7c
1½" long, 3 for..17c
3" long, 3 for..30c

PURSUIT or SWIVEL MACHINE GUNS (DIE CAST)

⅝" long, 3 for 6c
1¼" long, 3 for..11c
1⅝" long, 3 for..16c

2-BLADED PROPS (DIE CAST)

1½" long, 3 for..16c
2½" long, 3 for..22c
2⅝" long, 3 for..26c
4½" long, 3 for..31c

3-BLADED PROPS (DIE CAST)

1½" long, 3 for..20c
2½" long, 3 for..26c
3½" long, 3 for..31c
4½" long, 3 for..41c

DIE-CAST WING AND TAIL LIGHTS

3 Pcs. to a Set

For 12" model, 3 sets 18c
For 15" model, 3 sets 25c
For 24" model, 3 sets 35c

MODEL PINS

Per doz. pkgs....35c

MACHINE CUT PROPS

5"....per doz. 22c
6"....per doz. 25c
7"....per doz. 35c
8"....per doz. 38c
9"....per doz. 40c
10"....per doz. 50c
12"....per doz. 60c

WOOD VENEER

(For scale model work)

20"x30", 3 sheets for 25c

GENUINE SUPER-FINE TISSUE

(Cover your champion endurance ships with this paper.)

18x24, per doz....50c

ALUMINUM LEAF

.0003 of an inch thick
3½" wide, 100 ft. for 35c

FRESH RUBBER A GRADE

3/32 flat, skein 250 ft. 20c
⅛ flat, skein 250 ft. 25c

For a short time only, we have cut our prices on die-cast parts. We are doing this for the sole purpose of acquainting new customers and friends with our products. We feel sure that once these friends get to know the DIAMOND quality, they will stick by us forever. Time and again, dealers have written us commending us on our services, prices, and quality. You, too, can feel the utmost in security if you deal with a reliable supply house. Don't hesitate. Order NOW while prices are lowest.

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With each order for $2.50 or more of supplies we give FREE: 1 doz. Insignia Sheets; regular wholesale price 40c; retail value $1.40 FREE! With each order for $5.00 or more of supplies we give Free—1 skein of para rubber and 1 dozen large insignia sheets. Wholesale price $1.17; retail value about $4.00.

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Waco, 1933, Cabin; landing lights, flares, steel propeller; motor just majored.

Waco BSO J-65, landing lights, special paint, real bargain.

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FEBRUARY Issue

POPULAR AVIATION

On Sale January 10th

Air Board

(*Continued from page 22*)

seater "The Ace" with a 40 horse-power Ford engine!

The consensus of opinion of the Board was that converting automobile engines was interesting; that the value of such conversions had not yet been proved; but that efforts in this direction should be sympathetically regarded until practice and service experience gave the final answer.

A LETTER FROM THE FRENCH AIR MINISTER

The Board was gratified at receiving a cordial and lengthy letter from Pierre Cot, the French Air Minister. It was most pleasing to learn that Monsieur Cot was highly aware of the necessity of safety. In particular he stressed the complete meteorological coverage of the race with radio cooperation by the American, British and French weather bureaus. It appears also that steamships spaced over the route of the race will be carefully placed in communication with contestants by two-way radio.

RULES OF THE TRANS-ATLANTIC AIR RACE

The salient points of rules of the race, which is to commemorate Lindbergh's famous flight on May 21st, 1927, are as follows:

The race will be held May 21st, 1937, or shortly thereafter, depending on weather conditions.

The N.A.A. and the Aero Club of France are charged with duties of organization and supervision.

The winner will receive one million francs. Second prize will be five hundred thousand francs. Third prize will be three hundred thousand francs. Fourth prize will be two hundred thousand.

The finish will be over a line laid out at Le Bourget Airport. The contest is open to land aircraft. The make-up of the crew is optional. It is required only that the pilots hold a pilot's license, an "adminstrative license" and a sporting license for the current year.

All aircraft taking part in the race must be equipped with a radio telegraph or combination telegraph and telephone apparatus, sending and receiving patrol and generator weighing at least 80 kilograms, or made up to this weight by ballast. Aircraft are of course to be licensed. Aircraft must make a satisfactory flight under supervision of the officials of the National Aeronautic Association for at least one hour's duration without load requirements.

The Board charged its Chairman to submit to the N.A.A. the following respectful suggestions:

The phrase "the contest is open to land aircraft" is somewhat ambiguous; it probably means that land planes as well as seaplanes will be allowed to participate, but needs clarification.

There does not seem to be any reason why the radio equipment should weigh at least 80 kilograms, or roughly 176 pounds. If a lighter, more efficient set is available, it would be only reasonable to use a lighter set.

The crew should include at least a pilot,

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Gives This Sensational Performance

Flies 20 M.P.H. Over 30 minutes on ½ oz. gas (capacity 1 oz.). Takes off in 25 feet. Lands at 16 M.P.H. Full Size Plans.

Full size plans, ready cut out ribs, Latest Type M. & M. air wheels, aluminum motor mount, sheet aluminum for cowling, special metal fittings, veneer, all balsa parts cut to correct size, tubing, rods, springs for shock absorbing landing gear and clear and colored dopes. This fine kit is complete down to special bolts, screws and many other parts too numerous to mention here.

Span OVER 6 FT.
Length OVER 3½ FT.

The Baby Cyclone or any light model engine can be installed in this Rearwin Model.

HIGH QUALITY and REAL VALUE. COMPLETE KIT only **$7.00**

COMPLETE KIT INCLUDING BABY CYCLONE MOTOR **$22.75**

Add 50c extra to cover cost of packing and mailing.

(West of Mississippi add 10%; Canada, 10%; Foreign, 15%.)

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a co-pilot and a radio operator for obvious reasons.

A GREAT HANDICAP TO AMERICAN CONTESTANTS

As the Racing Committee of the N.A.A. is going into these matters and others, taking up the question of pilot's competence in navigation, the matter of fuel carried, and other items and as supplementary regulations are to be issued by December 31st, no doubt other safety measures will be included which will mitigate the hazards of the race. But Dean Smith brought up one very important point. Are not American contestants seriously handicapped in this race just as they were in the South African race and in other international races?

Apparently competitors of any other nation can load any amount of fuel they want. American contestants must meet the Department of Commerce load regulations for safe flying and carry only 25% overload over their ordinary licensed useful load. Either all foreign planes should conform to similar regulations or else the Department of Commerce should waive this requirement for this particular race.

It was perfectly proper, as Captain Depew pointed out, to surround the race with as many safeguards as possible, but Colonel Lindbergh flew without any regulations. Had he to-day's regulations to meet before setting off on his flight, he would never have got across!

The Board made the strongest possible recommendation to the effect that the N.A.A. and Department of Commerce should go into this question thoroughly and if possible remove this handicap which would be so seriously detrimental to American entries.

Teachers in accredited schools are invited to write the Subscription Department of POPULAR AVIATION for details of a group subscription plan.

END

Altimeter

(*Continued from page* 30)

By using an emitted or projected sound of 2,000 cycles, the receiving device can pick up the echo with the propeller and engine noises filtered out. A 2,000 cycle per minute sound wave is a note that is equivalent to an octave above middle "C."

Another item that is taken into consideration in computing altitude with this instrument is the "pitch" of the echo. Upon approaching a hill, for example, the "pitch" becomes greater, and becomes less when the hill falls away or recedes.

So that one may more fully understand the principle involved, the accompanying illustration may help to clear up any question in the mind of the reader as to the way the sound is projected and the way it returns.

As a rock is dropped into a pond and waves are formed which reach the farthest shore, so do sound waves work, and when they strike something, that object or surface returns its own set of waves as an echo. The time it takes for the sound to be echoed back to the point from which it originated will thus give the true altitude.

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Each kit is packed securely in an attractively colored gift box.

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come complete with all the tools for assembling — RAZOR, CLAMPS, BRUSH and SANDPAPER.

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WACO "C" CABIN

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* LETTERS ON FILE

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WING SPAN 20" Length, 11½"

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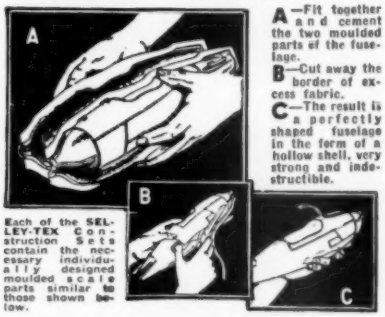

A—Fit together and cement the two moulded parts of the fuselage.

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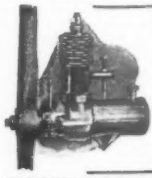

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(*Continued from page 47*)

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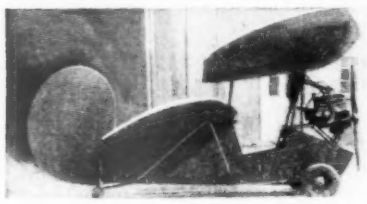

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OF POPULAR AVIATION, PUBLISHED MONTHLY AT CHICAGO, ILL., FOR OCTOBER, 1936.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared A. T. Pullen, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the POPULAR AVIATION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, W. B. Ziff, 608 S. Dearborn St., Chicago, Ill.; Editor, B. G. Davis, 608 S. Dearborn St., Chicago, Ill.; Managing Editor, J. B. Rathbun, 608 S. Dearborn St., Chicago, Ill.; Business Manager, A. T. Pullen, 608 S. Dearborn St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Ziff-Davis Publishing Company, 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff Co., 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff, 608 S. Dearborn St., Chicago, Ill.; B. G. Davis, 608 S. Dearborn St., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily publications only.)

A. T. PULLEN
(Signature of editor, publisher, business manager, or owner.

Sworn to and subscribed before me this 1st day of October, 1936.

[SEAL.] M. GNASS

(My commission expires February 26, 1940.)